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research division

DSS CONTRACT 23SQ.23440-4-9246
OFFSHORE STRUCTURES
EVALUATION OF SUITABILITY OF EXISTING
REPAIR MATERIALS (PHASE I)
MANUFACTURERS TEST DATA AND LITERATURE REVIEW

FINAL REPORT

Report No. 87-78-P

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ABSTRACT

A literature review of the existing concrete repair materials was conducted. Data on 222 products from 57 manufacturers are summarized in tables. A summary of the physical properties, advantages, disadvantages and uses of typical repair materials is also reported. It appears that the information provided by the manufacturers is varied in scope and, in some cases, is not relevant to field applications. It is apparent that there is an urgent need to develop standard test procedures and acceptance criteria for the various types of repair materials. Nine materials were selected from the products reviewed for laboratory testing. The results of the testing program have been summarized in Ontario Hydro Research Division Report No. 87-79-P.

Work on this project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources, Canada.

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CANMET Scientific Authority: H. Wilson

figures.

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DSS CONTRACT 23SQ.23440-4-9246 - OFFSHORE STRUCTURES
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J.J. Deans, P.K. Mukherjee and E.J. McColm

1.0 INTRODUCTION

As a portion of DSS contract 23SQ.22440-4-9246 "Evaluation of Suitability of Existing Repair Materials," a literature review of the existing repair materials was conducted. Information and data on currently available products were obtained by contacting manufacturers, consultants, universities, research organizations and government agencies/1 to 21/. This report summarizes the product information supplied by the manufacturers and also includes a summary of the advantages, disadvantages and applications of frequently used repair materials (Appendix A).

A laboratory testing program was conducted subsequent to this literature review and the test results have been summarized in Ontario Hydro Research Division Report No. 87-79-P.

2.0 DISCUSSION

For this review, 500 organizations, mainly in Canada, the United States and the United Kingdom, were contacted regarding their experience with repair materials for use in concrete structures. Of the material suppliers, 198 provided information on their products, but because of time restrictions only 57 of these were reviewed in detail. From the 57 companies (Table 1), the data for approximately 575 products were examined, and from these products, 222 appear to have physical characteristics suitable for the repair of concrete. The materials reviewed represent a good cross section of the products currently available on the market.

Appendix B contains a summary of the product data provided by the manufacturers. The materials have been broken down into two categories: Organic and Inorganic. Under these headings the products have been further classified as Crack Repair Materials and Patching and Bonding Materials. The definition of these classes of repair material is outlined below.

2.1 Crack Repair Materials

Cracks in concrete are generally caused by tensile forces in excess of the tensile strength of the concrete. They can frequently be sealed by injection of a repair material or by application of a bonding material to the crack surfaces.

2.2 Patching and Bonding Materials

Patching and bonding materials are used to repair defects on concrete surfaces due to aggressive environments, spalling, delamination, etc. These defects are considered too shallow for concrete filling and are generally no deeper than the reinforcement nearest to the concrete surface.

2.3 Manufacturers Data

The product data supplied by the manufacturers include information on composition, physical and mechanical properties, environmental resistance, and recommended applications. Since this information was not always relevant or consistent, a standardized table (Appendix B) to record the product data was provided to all the manufacturers contacted. This was done to facilitate the comparison of the products. However, it was found that the testing methods and the description of the materials varied significantly among the manufacturers. The tables, therefore, may not contain a complete summary of the data supplied. The number of products reviewed also had to be limited and some products were not included in the tables.

2.4 Characteristics of Repair Materials

A summary has been prepared listing the advantages, disadvantages and applications of generic types of repair materials. This summary is contained in Appendix A and was prepared using the data supplied by the manufacturers and information provided by the various organizations and agencies contacted.

3.0 REMARKS

3.1 An attempt has been made to summarize the existing data on the repair materials currently available on the market. It appears that the information provided by the manufacturers is so wide in scope and varied in application that an evaluation of any product based on the existing data is very difficult if not impossible.

3.2 It is apparent that there is an urgent need to develop standardized testing procedures and acceptance criteria for various types of repair materials.

3.3 Based on the existing data and literature review, nine products were selected for laboratory testing. Further details on the test program have been given in Ontario Hydro Research Division Report No. 87-79-P.

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REFERENCE

List of Organizations Contacted and Literature Reviewed

Organizations*	Contact Person
1. Department of the Air Force Air Force Engineering & Services Center Tyndall Air Force Base, FL 32403	R. Costigan
2. Colbrand Ltd. 20 Warwick Street Burnaby, B.C. V5C 6BE	N. Tusch
3. Chalmers University of Technology Division of Building Materials 5-412 96 Goteborg, Sweden	R. Tepfers
4. California State University 1250 Bellflower Blvd. Long Beach, CA 90840	Dr. Plecnik
5. Department of Army Cold Regions Research & Engineering Laboratory U.S. Corps of Engineers Hanover, NH 03755-1290	C.J. Korhonen
6. Czechoslovak Academy of Sciences Institute of Theoretical and Applied Mechanics Prague 2 Vysehradska, Czechoslovakia 12849	R.A. Bares
7. Mobile Research & Development Corp Offshore Engineering PO Box 819047 Dallas, TX 75381	G. Noff
8. Robert McAlpine Company 5820 North Federal Highway, Suite B Boca-Raton, FL 33431	J. Johnson
9. Bureau of Reclamation and Research PO Box 25007 Denver, CO 80225	J. Pearce

List of Organizations Contacted and Literature Reviewed (Cont'd)

Organizations*		Contact Person
10.	Wimpey Laboratories Beaconsfield Road Hayes, Middlesex England, UB4 0L5	J. Tabor
11.	Univestiry of Texas, Austin Department of Engineering Austin, TX 78712-1076	D. Fowler
12.	US Department of Transportation Federal Highway Administration - Research and Development Turner Fairbank Highway Research Center 6300 Georgetown Pike McLean, VA 22101	R.E. Hay
13.	Wiss, Janey Estner Assoc Consulting Engineer 330 Pfingsten Road Northbrook, IL 60062	W.F. Perenchio
14.	Abam Engineering Ltd. 33301 9th Avenue S Federal Way, WA 98003-6395	B. Lafrough
15.	Department of the Army Waterways Experiment Station Corps of Engineers PO Box 631 Visksburg, MS 39180	W.F. McCleese
16.	Cement and Concrete Association Wexham Spring Slough, U.K. SL36PL	G. Taylor
17.	Drexel University Philadelphia, PA 19104	S. Popovics
18.	Technical Research Center of Finland Concrete and Silicate Lab SF-02150 ESP0015 Finland	S. Pihlajavaara

List of Organizations Contacted and Literature Reviewed (Cont'd)

Organizations*	Contact Person
19. Ecole Polytechnique Federale De Lausanne 32 ch de Bellerive CH-1007 Lausanne Switzerland	F. Whittman
20. Virgina Highway & Transportation Research Council	
21. A.G.P.C. Offshore PO Box 47 Doha Arabian Gulf Saudia Arabia	J. Saliba

Literature**

22. Are Inc-Eng Consultants "Cost Effective Spall Repair of Concrete Pavements - Research Project No. 84-4 P.D.O.T" July 1986

23. "Guide for the Design and Construction of Fixed Offshore Concrete Structures," ACI 357R-84.

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25. Champion, S., "Failure and Repair of Concrete Structures," John Wiley & Sons Inc.

26. Tabor, L.J., Wimpey Laboratories, "Evaluation of Resin Systems for Concrete Repair," Magazine of Concrete Research, December 1978.

27. Chung, H.W. and Lui, L.M., "Epoxy Repaired Concrete Joints Under Dynamic Loads," ACI Journal, July 1978.

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29. Bradbury, A., "Laboratory Evaluation of Concrete Patching Materials," M1-67, September 1984.

30. US Department of the Interior, "Standard Specification for Repair of Concrete," M-47, January 4, 1982.

31. ACI Committee Report No. 2241 R84 "Causes, Evaluation and Repair of Cracks in Concrete Structures," ACI Journal, May-June, 1984.

32. Higgins, D., "Repairs to Cracks in Concrete" Concrete, February 1983.

33. Kvenning, W.H., "How to Repair Cracks by Grouting with Epoxy Resin," Concrete Repair Techniques.

34. "World of Concrete 84 Concrete Construction Publications," Washingon Convention Center, February 26-March 1, 1984, Concrete Repair Materials.

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* The above references are a listing of some of the organizations contacted.

** Technical literature relevant to this study is listed. In addition, several other documents and standards were reviewed.

TABLE 1

Evaluation of Suitability of
Existing Repair Materials
Companies Whose Products Were Reviewed

Canadian	American
Canada Cement	AC Horn Inc.
Cappar	Adhesive Engineering
Ceilcote Canada	Alpha Corporation
Dow Chemicals	American Admixtures
Dural International Corporation	Arcal Chemicals Inc.
Durdick	Avanti International
FRC Composites	Bonsal Company
Fosroc Canada Inc.	Burke Company
General Polymers	CHEMSTOP
Intrusion Prepakt	Celtite Inc.
Larsen Products	Dayton Superior
Master Builders	DeNeef America
Miniwax Construction Products	Devcon Corp.
Permagile Salmond Ltd.	Elkem Chemicals Inc.
Polysar Latex	Euclid Chemical Company
Protex Industries	Fox Industries
Set Products	HEY'DI American Corp.
Sika Canada	Hydrozo
Sternson	L&M Construction
Tamms Industries Co.	Nbec Corporation
Target Products	Nox-Crete Chem. Inc.
Thoro System Products	Polyvinyl Chemical Industries
Tremco Canada Ltd	Richhold
	Sauereisen
	Secure Incorporated
	Select Products
	Sikikal North American Inc.
	Sonneborn
	Speciality Compound
	Thompson's Co. Inc.
	US Grout
	United Coatings Inc.
	VIP
	W.R. Meadows

APPENDIX A

EVALUATION OF SUITABILITY OF EXISTING REPAIR MATERIALS

CHARACTERISTICS OF GENERIC REPAIR MATERIALS

APPENDIX A

EVALUATION OF SUITABILITY OF EXISTING REPAIR MATERIALS

CHARACTERISTICS OF GENERIC REPAIR MATERIALS*

The physical properties, advantages, disadvantages and typical applications of commonly used repair materials have been summarized in this appendix. These materials form the basis of many of the commercial products currently available on the market.

The advantages and disadvantages listed refer to the generic types of materials. Individual product formulations may perform differently. The summary tables contain available information and may not include all performance characteristics and applications.

The types of repair materials summarized in this appendix are listed below.

	Page
Epoxies	11
Polyesters	12
Urethanes	13
Methyl-Methacrylate	14
High Molecular Weight Methacrylate	15
Acrylic Latex	16
Styrene Butadiene Rubber	17
Poly Vinyl Acetate	18

*"World of Concrete 84 Concrete Construction Publications," Washington Convention Center, February 26-March 1, 1984, Concrete Repair Materials.

EPOXIES

PHYSICAL PROPERTIES

Vary with formulation
Vary with temperature
Coefficient of thermal expansion greater than that of concrete

ADVANTAGES

Good adhesion
High compressive/tensile/flexural strength
Excellent freeze/thaw resistance
Good resistance to chemical attack
Good wear resistance
Impermeable
Minimal shrinkage
Excellent radiation resistance
Some formulations are water compatible
Viscosity can be varied
Dimensionally stable

DISADVANTAGES/LIMITATIONS

Physical properties different from concrete
Adversely affected by improper proportioning and lack of mixing
Can cause allergic reaction in workers
High exothermic reaction when used neat
Limited thickness
High coefficient of thermal expansion
Physical characteristics are reduced at elevated temperature
Higher creep than that of concrete
Curing time dependent upon application temperature
Some systems can not be used in a moist environment

APPLICABLE STANDARD

ASTM C 881-884
D 1763, D695
D 2471, D696
ACI 503

TYPICAL APPLICATIONS

Bonding fresh concrete to old concrete
Bonding old concrete to old concrete
Bonding other materials to concrete

Protective coating

Sealing water leakage (Injection)
Structural restoration of cracks (Injection)

Grouting preplaced aggregate

Patches

Overlays

Anchor grouting

POLYESTERS

PHYSICAL PROPERTIES

Vary with formulation
Vary with temperature
Coefficient of thermal expansion greater than that of concrete

ADVANTAGES

Good chemical resistance
Easy to use
Good physical properties (some formulations)
Good wear resistance
Resistant to staining
Impact resistance similar to concrete
Impermeable

DISADVANTAGES/LIMITATIONS

Higher shrinkage and expansion than that of concrete
Relatively poor adhesive properties
(some formulations)
Hydrolysis
High exothermic reaction
Strong odour

APPLICABLE STANDARD

ASTM D2393
D1338
D838

TYPICAL APPLICATIONS

Floor coatings
Sealer for epoxy injection
Binder for polymer mortar
Protective coatings
Anchoring
Adhesive bonder or sealer
Binder for fiberglass
Thin overlays

URETHANES

PHYSICAL PROPERTIES

Vary with formulation
Vary with temperature
Coefficient of thermal expansion greater than that of concrete

ADVANTAGES

Easy to use
Good chemical resistance
Good wear resistance
Impermeable
Minimal shrinkage
Adequate working time

DISADVANTAGES/LIMITATIONS

Curing affected by humidity
Sensitive to temperature differentials
Stability questionable under certain conditions

APPLICABLE STANDARD

ASTM D2393
D1338
D838
D695

TYPICAL APPLICATIONS*

Waterproofing	Protective coating	Floor coating
Water control grouting (moist cured)	Insulation	Anchor grout

*Water activated (single component)
Chemically activated (two components)

METHYL-METHACRYLATE (MMA)

PHYSICAL PROPERTIES

Vary with formulation
Vary with temperature
Low viscosity
Coefficient of thermal expansion greater than that of concrete

ADVANTAGES

Rapid strength gain
Good bond to dry surface
Easy to mix
Available as prepackaged material
High compressive/flexural/shear/tensile strength
Impermeable to water
Excellent resistance to acid
Good abrasion resistance

DISADVANTAGES/LIMITATIONS

Expensive
Hazardous (flammable)
Sharp pungent odour
Moisture sensitive (aggregate/surface must be dry)
Higher expansion/shrinkage than that of concrete

APPLICABLE STANDARD

None found

TYPICAL APPLICATIONS

Polymer concrete
Patches
Impregnation
Overlays
Thin toppings
Precast elements

HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM)

PHYSICAL PROPERTIES

Low viscosity
Coefficient of thermal expansion greater than that of concrete
Elastic modulus varies with formulation

ADVANTAGES

Concrete sealer/crack repair
- Low viscosity
- Excellent penetration
- Easy to apply

Polymer Concrete
- Excellent bond
- High compressive/flexural strength
- Rapid strength gain
- Impermeable to water
- Good acid resistance

DISADVANTAGES/LIMITATIONS

Very expensive
Moisture sensitive
Excessive shrinkage
Odour

APPLICABLE STANDARD

None found

TYPICAL APPLICATIONS

Surface sealer

Crack filler

Topping/overlay

Small patches

ACRYLIC LATEX

PHYSICAL PROPERTIES

Vary according to concentration

ADVANTAGES

Improves flexural/impact/shear/tensile strength
Good adhesion
Ultraviolet resistance
Water resistance
Good freeze/thaw resistance
Low permeability to salt solutions
Excellent resistance to discolouration
Moist curing not necessary
Chemical resistance good with some materials

DISADVANTAGES/LIMITATIONS

Short working life
Requires special equipment for large application
May soften under continuous moisture
Variations on strength development will depend on dosage
Abrasion resistance varies

APPLICABLE STANDARD

MIL-B-19235

TYPICAL APPLICATIONS

Bond fresh concrete to old concrete
Floor underlay
Patches and overlays
Cement, plaster, stucco
Spray coat and fill coat

STYRENE BUTADIENE RUBBER (SBR)

PHYSICAL PROPERTIES

Vary according to concentration

ADVANTAGES

Good adhesion
Good chemical resistance with some materials
Improves flexural/compressive/tensile bond strength
Reduces permeability
Good stability and aging characteristics
Unaffected by addition of calcium chloride
Requires minimal curing

DISADVANTAGES/LIMITATIONS

Short working time
Requires special equipment for dispensing in concrete
Placing temp must be above 5°C
Discolours with age
May coagulate if subjected to high temperatures
Not stable with most air-entraining agents
Wet cure and air dry can give different results
Addition rates will affect strength
Requires special finishing skill

APPLICABLE STANDARD

FHWA RD78-35

TYPICAL APPLICATIONS

Bond fresh concrete to old concrete

Patches and overlays

Areas subjected to mild chemical attack

POLY VINYL ACETATE (PVA)

PHYSICAL PROPERTIES

Vary according to concentration

ADVANTAGES

Easy to use
Stable under sunlight
Improved aging characteristics

DISADVANTAGES/LIMITATIONS

Must be protected before drying (some formulations)
Re-emulsifiable (some formulations)
Poor freeze/thaw resistance

APPLICABLE STANDARD

MIL-B-19235A

TYPICAL APPLICATIONS*

Adhesive bond coat

Adhesive for patches/overlays

Concrete/mortar additive

Bonding agent for plaster

*Non-re-emulsifiable and re-emulsifiable

APPENDIX B

EVALUATION OF SUITABILITY OF EXISTING REPAIR MATERIALS

SUMMARY OF MANUFACTURERS PRODUCT DATA

APPENDIX B

EVALUATION OF SUITABILITY OF EXISTING REPAIR MATERIALS

SUMMARY OF MANUFACTURERS PRODUCT DATA

This appendix forms a part of Ontario Hydro Research Report No. 87-78-P and includes a series of tables. These tables contain technical data on proprietary products currently available for the repair of concrete structural components. The data have been supplied by the manufacturers of the products and have been put together in a standardized format. The format was designed so that most of the information could be listed. The blank spaces in the tables indicate that no information was provided by the manufacturer. Since there were many differences in the test methods adopted by the manufacturers, it may be difficult to compare the data between products. An attempt has been made to review a representative number of products currently available on the market. New products are frequently being introduced and technical data are not always readily available. Therefore, the information in the tables requires continuous updating.

The tables, identified as "A" to "V," are computer printouts of manufacturers information. The following three pages contain the indexing system for the tables. The index page includes a file name which is assigned to a diskette containing the data. Copies of these diskettes are attached with this appendix. All information on the files was compiled using "Lotus 123 Ver 1." The information on the diskettes may be updated to reflect any changes that the manufacturers issue from time to time.

The disk files contain proprietary information and shall not be distributed without prior approval of Ontario Hydro and CANMET.

INDEX FOR TABLES SUMMARIZING MANUFACTURERS PRODUCT DATA

TABLE NO.	FILES* NAME	DISK #	PRODUCT TYPE AND APPLICATION	MANUFACTURER'S NAME
A	INCRACK	3	Inorganic - Crack Repair	Burk, Celtite, Dayton Superior, Euclid, FRC Composites, HEY'DI, Minwah, Target Products, Thoro Sys., Tremco, Sika
B	ORCRACK1	3	Organic - Crack Repair	Adhesive Eng, Cappar, Celtite, Ceilcote, De Neef, Dural
C	ORCRACK1	3	Organic - Crack Repair	Dural, Euclid, Fox Industries, Fosroc, General Polymers
D	ORCRACK1	3	Organic - Crack Repair	General Polymers, L&M Const., Permagile - Salmond, Protex, Select Products, W.R. Meadows
E	ORCRACK2	1	Organic - Crack Repair	De Neef, Chimie, Prime Resins, E-Poxy Indust., American Chemical, Chemque, Sonneborn, Speciality Compounds, Sternson, Tremco
F	ORCRACK2	1	Organic - Crack Repair	Sika
G	INPATCH1	3	Inorganic - Patching and Bonding Material	AC Horn, Bonsal, Burk, Canada Cement, Celtite, Dayton Superior, Euclid, Fox Industries, Fosroc
H	INPATCH1	3	Inorganic - Patching and Bonding Material	FRC Composities, Intrusion Prepakt, L&M Construction, Master Builder, Miniwah, Nbec Corp., Protex, Sonneborn, Sternson, Tamms, Target
I	INPATCH1	3	Inorganic - Patching and Bonding Material	Thoro System, US Grout, Gemite Unique, FEB, Tremco
J	INPATCH2	2	Inorganic - Patching and Bonding Material	HEY'DI (USA & Germany), Sika

*Lotus 123, Version 1

INDEX FOR TABLES SUMMARIZING MANUFACTURERS PRODUCT DATA(Cont'd)

TABLE NO.	FILES* NAME	DISK #	PRODUCT TYPE AND APPLICATION	MANUFACTURER'S NAME
K	ORPATCH1	1	Organic - Patching and Bonding Material	AC Horn, Adhesive Eng
L	ORPATCH1	1	Organic - Patching and Bonding Material	Bonsal, Burk, Cappar, Celtite, Dow Chemicals, Ceilcote, De Neef, Dural
M	ORPATCH1	1	Organic - Patching and Bonding Material	Dural
N	ORPATCH2	1	Organic - Patching and Bonding Material	Dural, Euclid, Fox Industries
O	ORPATCH2	1	Organic - Patching and Bonding Material	Fox Industries, Fosroc, General Polymers, Larsen Products, L&M Construction, WR Meadows
P	ORPATCH2	1	Organic - Patching and Bonding Material	Nox-Crete Chem, Permagile-Salmond, Protex (Conchem)
Q	ORPATCH3	2	Organic - Patching and Bonding Material	Protex (Conchem), Select Products, Set-Products, Shell
R	ORPATCH2	2	Organic - Patching and Bonding Material	Sonneborn, Speciality Compound, Sternson, Thoro System, Dow Chemicals
S	ORPATCH3	2	Organic - Patching and Bonding Material	Dow Chemicals, Belzona Molecular, Prime Resins Inc, American Chemical
T	ORPATCH4	2	Organic - Patching and Bonding Material	E-Poxy Industries, Chemque, FEB

*Lotus 123, Version 1

INDEX FOR TABLES SUMMARIZING MANUFACTURERS PRODUCT DATA(Cont'd)

TABLE NO.	FILES* NAME	DISK #	PRODUCT TYPE AND APPLICATION	MANUFACTURER'S NAME
U	ORPATCH4	2	Organic - Patching and Bonding Material	Tremco, HEY'DI, Deutsch HEY'DI
V	ORPATCH4	2	Organic - Patching and Bonding Material	Sika Canada

*Lotus 123, Version 1

A

TABLE A
INORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors)		Generic Type	PLACEMENT				
	NAME	Origin		Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Working Time Time min.	Working Time Sampl Size
Burk Acrylic Patch	Burk	USA	Acrylic Patch	Plastic	>32		10	
10-45 Poly Plug	Celtite	USA	Polymer Mod cement	Plastic	41-100		360	
All-Crete 5 min Set	Dayton Superior	USA	Cement	Plastic	>(-20)		3 (2)	
All-Crete 20 min Set	Dayton Superior	USA	Cement	Plastic	>(-20)		10 (2)	
Water Stop	Dayton Superior	USA	Cement	L-P	>35		1.5 (2)	
K - Ment	The Euclid Co.	USA	Hydraulic cement	L-P	>40		35-40	
Euco Poly Patch	The Euclid Co.	USA	Cement	Plastic	50-100		45	
Tapecrete	F.R.C.Composites	CAN	Polymer Mod cement	L-P	>45			
HEY'DI RAPID	HEY'DI American	USA	Cement	Plastic	39 +	75	8	
Por Roc	Minwax (National Lab.)	CAN	Cement	Liquid		70	18	
Unsanding Expanding Grout	Target Products	CAN	Cement	L-P	50-75			
Thorite	Thoro System	CAN	Cement	L-P	>40		5-10	
Trancrete	Tranco	CAN	Acrylic Polymer Mod cement	Liquid	>45			
TranGrout-GP	Tranco	CAN	Cement	Fluid	41 +	77	20	25 K
TranGrout-HF	Tranco	CAN	Cement	Fluid	41 +	77	20	25 K
Sika Grout 212 Premixed Grout	Sika Canada Inc.	CAN	Cement	L-P	-50 + 350	73	30	

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) ASTM C-266

L-P - L

CEMENT king Time					MECHANICAL PROPERTIES																			
Time min.	Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std	Flexural Strength psi	age	std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E +5psi	age	std	Coeff. of Thermal Expansion 10E-6 /F	age	std	Creep Result	age	std
10				X	3340 air cure 2800 water cure	5050 air cure 6525 water cure							>250												
360		X	X	X	2300	4500	415	7d	C-190															
(2)				X	5410	8320																		
(2)				X	4830	7100																		
5 (2)				X	1870	3650																		
5-40			X	X		6500																		
45			X																					
			X	X		See Remarks	7000						650											
8				X	1830 C-109	4630 C-109																		
18			X		5340 air dry	6915 air dry 9254 water 5890 CRD C-621							4900-6800											
5-10			X		812	3910																		
		X	X			See Remarks	745		C-190	775		C-109	475		C-321	1585		C348						
20	25 Kg	X	X		3,644 C-109	7,463 C-109	680	28 d								900	28 d		42.0	28 d		2.4	28 d	
20	25 Kg	X	X		2,623 C-109	5,727 C-109	630	28 d								1,450	28 d		42.0	28 d		1.7	28 d	
30			X		4,932 Trowel 4,061 Pourabl	7,978 Trowel 7,252 Pourabl	580 870	7 d 28 d	C-496 C-496				9,428 -Pull Out						0.055	28 d	D-695			

L-P - Liquid to Plastic

MECHANICAL PROPERTIES				RESISTANCE								PRODUCT NAME	REMA
Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E +5psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volume Change Plastic or Hardened % age std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std		
												Burk Acrylic Patch	Under water repairs
				FAIR	GOOD	GOOD	GOOD	GOOD		GOOD		10-45 Poly Plug	STOP water leaks
												All-Crete 5 min Set All-Crete 20 min Set Water Stop	Repair large floor cracks; Patc Repair large floor cracks; Patc Crack Repair; Patching
												K - Ment	Crack Repair (Small cracks); Pa
												Euco Poly Patch	Crack Repair (Fill cracks); Pat
				GOOD	EXCEL							Tapecrete	Crack Repair; Bonding; Patching Withstand crack movement of 0 Compressive Strength - 10500
												HEY'DI RAPID	Crack Repair; Patching; Quick s
												Por Roc	Crack Repair; Patching
			0.24 7d									Unsanding Expanding Grout	Crack Repair (Repair non-moving
												Thorite	Crack Repair; Patching
										1.15% C-241		Tremcrete	Crack Repair (Fills cracks also Compressive Strength - 5715 p
42.0 28 d	2.4 28 d		+0.049 28 d C-531	C	A	A	B	A				TremGrout-GP	General purpose non-shrink ceme
42.0 28 d	1.7 28 d		+0.043 28 d C-531	C	A	A	B	A				TremGrout-HF	High performance non-shrink cem
0.055 28 d D-695			0.042 3 d 0.050 28 d	POOR	FAIR							Sika Grout 212 Premixed Grout	General purpose grout for base anchors etc; Shrinkage compen

A - Intact, Unaffected
B - Intact, Abrades Readily
C - Intact, Softened to Rubber Consistency

PRODUCT NAME	REMARKS
Burk Acrylic Patch	Under water repairs
10-45 Poly Plug	STOP water leaks
All-Crete 5 min Set All-Crete 20 min Set Water Stop	Repair large floor cracks; Patching; Underwater applications Repair large floor cracks; Patching; Underwater applications Crack Repair; Patching
K - Ment	Crack Repair (Small cracks); Patching
Euco Poly Patch	Crack Repair (Fill cracks); Patching
Tapecrete	Crack Repair; Bonding; Patching Withstand crack movement of 0.02"; Compressive Strength - 10500 psi
HEY'DI RAPID	Crack Repair; Patching; Quick set cement grout.
Por Roc	Crack Repair; Patching
Unsanding Expanding Grout	Crack Repair (Repair non-moving cracks); Grouting
Thorite	Crack Repair; Patching
Tremcrete	Crack Repair (Fills cracks also water proofing) Compressive Strength - 5715 psi ASTM C-109
TremGrout-GP	General purpose non-shrink cementitious grout.
TremGrout-HF	High performance non-shrink cementitious grout.
Sika Grout 212 Premixed Grout	General purpose grout for base plates, machine bases, anchors etc; Shrinkage compensating.

B.

TABLE B
ORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	MECHANICAL Bond Strength psi	age	std
Concresive 1380	Adhesive Eng.	USA	Epoxy	Liquid	40-100	77 100	19 8.5	60g 60g	X	X			16000 D-695	9055		D-638	4490	7d	(2)	>PCC		
Concresive AEX 1439	Adhesive Eng.	USA	Epoxy	Liquid		77	170-260	100 g	X	X		17000 D-695		4000-6000	7d	D-638				>PCC		
Concresive 1459	Adhesive Eng.	USA	Epoxy	Plastic	40-95	40	150	100 g	X	X				1700	7d	D-638	DC >7500 CF	7d	(3)			
Concresive 1468	Adhesive Eng.	USA	Epoxy	Liquid	35-125	77 40	30 215	100 g 60 g	X	X			15000 D-695	8000	7d	D-638	WC 4000 WC 4500	3d 7d	(3) (3)	>PCC		
Concresive 1180	Adhesive Eng.	USA	Epoxy	L-P	>40	80 120 50 77	25 7 100 55	1qt 1qt	X	X	X		9000 D-695 Mortar 11000 D-695	3800	7d	D-638	DC 5000 DC 2900 WSC 2500	1d	(3) (3) (3)	>PCC		
16 Clear Conc Patch.	Cappar	CAN	Epoxy	Plastic	>0		18			X		15000	23000	6970						7380		(3)
CS 16 Poly Patch	Cappar	CAN	Polyester	Plastic	>0		30		X			10000	12000	2000								
83 Injection Resin	Cappar	CAN	Epoxy	Liquid	>0		18			X		15000	23000	7750						7380		(3)
CS22 Injection Resin	Cappar	CAN	Epoxy	Liquid	>0		30		X			13000	20000	9000								
CS31 Injection Resin	Cappar	CAN	Epoxy	Liquid	>0		48		X			12000	25000	9000								
CS-47 High Temp. Injection Resin	Cappar	CAN	Epoxy	Liquid	>0		60		X			2000	17000	12000								
CS-40 Low Density Injection Resin	Cappar	CAN	Epoxy	Plastic	>0		48		X			1000	3500	1500								
21-05 Universal	Celtite	USA	Polyester	L-P	32-90		6-180		X	X			15000 C-109	2000	7d	C-307						
21-12 Uniflex	Celtite	USA	Polyester	L-P	32-90		6-120		X	X		6000 C-109	7700 C-109	1560		D-638				350 CF		
42-45 Hi-Bond	Celtite	USA	Epoxy	Liquid	50-90		30-66		X	X	X		6500 D-695	4500		D-638				2480	2d	C-881
42-66 Hi-Dro Flex	Celtite	USA	Epoxy	Liquid	50-90		30-180		X	X	X	5000 D-695 1700	2500	517	7d							
647 Repair Grout	Ceilcote	CAN	Epoxy	Liquid	>32	70	30		X	X			See Remarks	5500		C-307Mod						
Taccs 025 NF	DE NEEF AMERICA	USA	Polyurethane	Liquid	50-86					X	X		See Remarks									
Aquaflex LV	Dural	CAN	Epoxy	L-P		75	60		X	X	X		Binder 6000 Mortar 9000	13000	7d							
Aquaseal LV	Dural	CAN	Epoxy	L-P		75	30		X	X	X		Binder 12000 Mortar 8000	4000	7d							
Duralcrete LV	Dural	CAN	Epoxy	Liquid	>50	75	30		X	X			See Remarks	Binder >4000								
Duralith	Dural	CAN	Epoxy	Liquid	>30	75	10-20		X	X			See Remarks	Binder >5000								
Flexocrete	Dural	CAN	Epoxy	L-P	>50	75	30-40		X	X			See Remarks	Binder >2500								

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) AASHTO T-237 Wet at 40 deg. F
(3) AASHTO T-237

CF = Concrete Failure
FC = Fresh Concrete
WC = Wet Concrete
DC = Dry Concrete

PCC = Portland Cement Concrete
WSC = Water Saturated Concrete
L-P = Liquid to Plastic Consistency
N/R = Not Recommended

MECHANICAL PROPERTIES																							RESISTANCE									
	Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) = Compressive (Et) = Tensile			Coeff. of Thermal Expansion			Creep			Volume Change													Abrasion		Freeze/Thaw	
kd	psi	age	std	psi	age	std	10E +5 psi	age	std	10E-6 /F	age	std	Result	age	std	Plastic or Hardened %	age	std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Result	std	cycles	std
2)	>PCC			12000		D-790	2.3(Ec)		D-695																				
	>PCC			4000			2.0(Ec)		D-695Mod																				
3)							0.11(Ec)	7d	D-695																				
3)	>PCC			13000	7d	D-790	4.0(Ec)	7d	D-695																				
3)																													
3)				DC 200		C-293	2.0(Ec)	7d	D-695																				
3)				WSC 160		C-293	Mortar												GOOD	GOOD		FAIR	GOOD					
				FC 250		C-293	2.55(Ec)																						
	7380		(3)	12500			4.5			36.0						0.3			GOOD	GOOD	GOOD	GOOD	EXCEL					
				5000			2.0			20.0									N/R	N/R	N/R	N/R	EXCEL					
	7380		(3)	11600			4.45			36.0						0.3			GOOD	GOOD	GOOD	GOOD	EXCEL					
				14000			3.25			36.0									GOOD	GOOD	GOOD	GOOD	EXCEL					
				16000			4.2			36.0									GOOD	GOOD	GOOD	GOOD	EXCEL					
				16000			4.1			36.0									GOOD	GOOD	GOOD	GOOD	EXCEL					
				2000						18.0									GOOD	GOOD	GOOD	GOOD	EXCEL					
	350 CF																		GOOD	GOOD	GOOD		GOOD		GOOD			
	2480	2d	C-881				2.5(Ec)	28d	D-695	26.6	7d	C-696				-0.03			GOOD	GOOD	GOOD		GOOD		GOOD			
																			GOOD	GOOD	EXCEL		EXCEL					
							Binder 2.25-3.0(Et) 2.0-3.0(Ec) Mortar 2.5-3.5(Ec)												GOOD	GOOD	EXCEL		EXCEL					
							Binder 2.25-5.0(Et) Mortar 2.25-6.0(Ec)																							
							Binder 0.9-1.3(Et) 0.9-1.3(Ec)																							

rdened std	RESISTANCE								PRODUCT NAME	REMARKS
	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std		
											Concresive 1380	Pressure Injection; Grouting Cracks; Heat Deflection Temperature - 134 F
												Pressure Injection; Grouting Cracks; Heat Deflection Temperature - 110 F ASTM D-648 7d
											Concresive 1459	Gap filling
											Concresive 1466	Pressure Injection; Rebonding cracked concrete; Heat Deflection Temperature - 145 F ASTM D-648 7d
	GOOD	GOOD		FAIR	GOOD						Concresive 1180	Crack Repair; Patching; Bonding
	GOOD	GOOD	GOOD	GOOD	EXCEL						16 Clear Conc Patch.	Wide cracks
	N/R	N/R	N/R	N/R	EXCEL						CS 16 Poly Patch	Pressure Injection
	GOOD	GOOD	GOOD	GOOD	EXCEL						#3 Injection Resin	Pressure Injection
	GOOD	GOOD	GOOD	GOOD	EXCEL						CS 22 Injection	Pressure Injection
	GOOD	GOOD	GOOD	GOOD	EXCEL						CS 31 Injection	
	GOOD	GOOD	GOOD	GOOD	EXCEL						CS-47 High Temp. Injection Resin	
	GOOD	GOOD	GOOD	GOOD	EXCEL						CS-40 Low Density Injection Resin	
	GOOD	GOOD	GOOD		GOOD		GOOD				21-05 Universal	Crack Repair; Patching
	GOOD	GOOD	GOOD		GOOD		GOOD				21-12 Uniflex	Flexible Polyester Grout; Patching Summer & Winter Grade
	GOOD	GOOD	GOOD		GOOD		GOOD				42-45 Hi-Bond	Crack Repair; Pressure Injection; Bonding
	GOOD	GOOD	GOOD		GOOD		GOOD				42-66 Hi-Dro Flex	Crack Repair; Patching; Coating; Underwater Applications
											647 Repair Grout	Crack Repair; Pressure Grouting Compressive Str. - 11000 psi ASTM C-579-75 Method B
											Tacc 025 MF	Crack Repair; Pressure Injection; Seal water leaks; Available in three types; Compressive Str. - 550 psi.
	GOOD	GOOD	EXCEL		EXCEL						Aquaflex LV	Crack Repair (Underwater); Pressure injection; Aquaflex LV used instead of Aquaseal LV when High Str., stress relief Thermal & Mechanical movement is required.
	GOOD	GOOD	EXCEL		EXCEL						Aquaseal LV	Crack Repair; Pressure Grouting; Mech. Prop. based on 75 deg F
											Duralcrete LV	Available in three consistencies: (ie:Adhesive & Mortar binder for Horiz. repairs; Pressure Injet. into fine cracks; Non-sag adhesive mortar and binder, Vert.& Overhead repairs) Compressive Str. - Binder >8000psi, Mortar >10000psi
											Duralith	Duralith system is available in two consistencies: (ie: adhesive and mortar binder for horizontal repairs, pressure injection, bonding, etc; and non-sag adhesive and binder for vertical and overhead repairs, patching etc.) This system is similar to Duralcrete; however, it is used at temp >30 F, while Duralcrete is used when a slower cure at higher temperatures is required; mechanical properties based on 75 F Compressive Str.-Binder >9000, Mortar >10000psi
											Flexocrete	Flexocrete system available as : Flexocrete (overlays, patching, sealing cracks), Flexocrete Gel (patching vertical and overhead surfaces); Compressive Str.-Binder >5000, Mortar >7000psi

C.

TABLE C
ORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Dam (1)
Flexolith	Dural	CAN	Epoxy	L-P	>30	75	15-30		X	X
Duralpatch LV	Dural	CAN	Epoxy	Liquid	>30	30 60 75 90	60 20 15 10		X	
Dural 211	Dural	CAN	Epoxy Poly-sulfide	L-P	>50	75	40	1 gal	X	
Dural 306	Dural	CAN	Epoxy	Liquid	>40	75	10-20		X	
Euco #452 LV	The Euclid Co	USA	Epoxy	Liquid		60 75 90	75 60 45	1 pint 1 pint 1 pint	X	
Epoxy Adhesive #620	The Euclid Co	USA	Epoxy	Liquid	>35	35 72 90	300 40 25		X	X
FX-751 LV	Fox Industries	USA	Epoxy	Liquid	>50				X	X
FX-731 LV	Fox Industries	USA	Epoxy	Liquid	>30	70	30-40		X	
FX-741 LV	Fox Industries	USA	Epoxy	Liquid	<40	40 70	60 16	60g 60g	X	
FX-771 LV	Fox Industries	USA	Epoxy	Liquid	>40	75	40		X	X
FX-791 LV	Fox Industries	USA	Epoxy	L-P	>40	75	60		X	X
Conbextra EP LV	Fosroc	CAN	Epoxy	Liquid	41-86	41 50 68	70 30 15		X	
Nitomortar S	Fosroc	CAN	Epoxy	Plastic	41-90	68 95	45 20		X	
Nitomortar Polyester Flex (Winter Grade)	Fosroc	CAN	Polyester	L-P	41-95	77	10-15		X	X
Deco Rez 3516	General Polymers (Superior Coatings)	CAN	Epoxy	Liquid		77	15-20			X

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) Slant Shear Bond to BSS 6319 Part 4

G-E = Good to Excelle
L-P = Liquid to Plast
WC = Wet Concrete

ime Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi age std	Shear Strength psi age std	Bond Strength psi age std	Flexural Strength psi age std	Modulus of Elasticity (Ec) = Compressive (Et) = Tensile 10E +5 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volume Ch Plastic o %
	X	X			See Remarks	Binder 2500-3500				Binder 0.9-1.3(Et) 0.9-1.3(Ec) Mortar 1.0-1.4(Ec)			
	X			Mortar >7000 C-109		Mortar >1300							
1 gal	X				See Remarks	Mortar 600							
	X					700-1200 D-638							
1 pint	X				Mortar 10000			655 1d					
1 pint													
1 pint	X	X		10500 C-109	15000 C-109	4000 7d D-638		3200 1d C-882	8000 7d C-348				
	X	X		With Filler 8500	Neat 11000 D-695 With Filler 13500	7000 D-638	3000 7d C-882		13400 14d D-790				
	X												
60g	X		X	Neat 13500	With Filler 9500								
60g				With Filler 9500									
	X	X	X		14000	1800 1d C-190				Mortar 22.0			
	X	X	X			6000 7d D-638							
	X				See Remarks	3916 C-307	7252 BSS-2782		7977 D-790	2.3		See remarks	
	X				See Remarks	1450 C-307	4060 BSS-2782	4785 (2)	2900 C-580	23.5	12.8	See remarks	Plastic 0.0 Hardened -0.10
	X	X		2320-2900		290	945 BSS-2782		580	0.5-1.0	15.5	See remarks	Plastic 1.5 Hardened 0.0
		X			See Remarks	9000 D-638	900 7d	800 1d	13000-14000 D-790				

E = Good to Excellent
P = Liquid to Plastic Consistency
= Wet Concrete

Coeff. of Thermal Expansion 10E-6 /F age	std	Creep Result age	std	Volume Change Plastic or Hardened % age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
																Flexolith	Flexolith system has similar uses and properties crete system; however, it is suited for low t applications (30 F). Flexolith system is ava Flexolith (overlays, patching, sealing cracks Flexolith Gel. Properties based on 75 F. Compressive Str. - Binder >5000psi, Mortar >7
																Duralpatch LV	Crack repair, pressure grouting non-moving crac Duralpatch system is available as: Duralpatch Duralpatch LV, Duralpatch Gel; Working time a ble for Duralpatch LV with aggregates.
																Dural 211	Bonding, patching, crack repair; Compressive Str. - Mortar >800psi
																Dural 306	Coal tar overlay and water proofing membrane; c to seal non-moving cracks.
																Euco #452 LV	Euco #452 Epoxy System is available as: #452 L dry and slightly damp cracks; Primer); #452 (grouting etc); #452 Gel (bonding, vertical an repair as a mortar).
																Epoxy Adhesive #620	Crack Repair (Pressure Injection); Epoxy Adhesi available as #620M (Mortar); #620 LV (low vis #620 Gel
																FX-751 LV	Crack repair (Pressure Injection in hairline cr seal crack with "FX-763 Hydro Ester".
																FX-731 LV FX-741 LV	Crack Repair (Pressure Injection), Grouting; Te 1500 psi (3 days), compressive str - 8000 psi Injection and Anchor bolt Grouting.
																FX-771 LV Hydro Ester High modulus FX-791 LV LP	Crack repair (Pressure Injection), Patching, Un applications.
																	Patching; Crack Repair (Pressure Injection, gra material has a long pot life. Do not use for naw to plastic conc; Material temp between 65 best penetration into cracks; Prior to crack r seal with FX 733.
		See remarks												50 No wt loss	C-67	Conbextra EP LV	Conbextra EP LV is available in 15 min and 30 Crack repair (Pressure Injection down to 0.00 Creep - 5 to 8 times that of concrete; Cracks >2 1/2" use Conbextra EPS or Conbextra Compressive str 10,750 psi, ASTM C-579.
12.8		See remarks		Plastic 0.0 Hardened -0.10		G-E	EXCEL	EXCEL	G-E					50 No wt loss	C-67	Nitomortar S	Crack repair; Patching; Creep - under loads; 2-3 of conc; Prime surface with "Nitoprime 28"; M 1/2" for vertical applications.
15.5		See remarks		Plastic 1.5 Hardened 0.0		FAIR	FAIR	FAIR	FAIR					50 No wt loss	C-67	Nitomortar Polyester Flow	Compressive str - 10,150 psi, ASTM C-579. Available in a summer or winter grade; Crack Re cracks 1/8" to 1/2", ie. saw cuts) Compressive strength - 2760 psi - 3260 psi at Creep - under loads, 2-3 times that of conc.
																Deco Rez 3516	Crack repair (Pressure Injection); Patching; Compressive str - 15,000 psi, ASTM D-695.

C3

C4

REMARKS
Flexolith system has similar uses and properties as the Flexocrete system; however, it is suited for low temperature applications (30 F). Flexolith system is available as: Flexolith (overlays, patching, sealing cracks) and Flexolith Gel. Properties based on 75 F. Compressive Str. - Binder >5000psi, Mortar >7000psi
Crack repair, pressure grouting non-moving cracks, Duralpatch system is available as: Duralpatch, Duralpatch LV, Duralpatch Gel; Working time also available for Duralpatch LV with aggregates. Bonding, patching, crack repair; Compressive Str. - Mortar >800psi
Coal tar overlay and water proofing membrane; crack filler to seal non-moving cracks.
Euco #452 Epoxy System is available as: #452 LV (grout dry and slightly damp cracks, Primer); #452 (overlays, grouting etc); #452 Gel (bonding, vertical and overhead repair as a mortar). Crack Repair (Pressure Injection); Epoxy Adhesive #620 is available as #620M (Mortar); #620 LV (low viscosity); #620 Gel
Crack repair (Pressure Injection in hairline cracks), seal crack with "FX-763 Hydro Ester".
Crack Repair (Pressure Injection), Grouting; Tensile str - 1500 psi (3 days), compressive str - 8000 psi (3 days). Injection and Anchor bolt Grouting.
Crack repair (Pressure Injection), Patching, Underwater applications.
Patching; Crack Repair (Pressure Injection, gravity feed), material has a long pot life. Do not use for bonding new to plastic conc; Material temp between 65 - 75 F for best penetration into cracks; Prior to crack repair, seal with FX 733.
Conbextra EP LV is available in 15 min and 30 min gel times Crack repair (Pressure Injection down to 0.008 inch); Creep - 5 to 8 times that of concrete; Cracks >2 1/2" use Conbextra EPS or Conbextra EPL. Compressive str - 10,750 psi, ASTM C-579. Crack repair; Patching; Creep - under loads; 2-5 times that of conc; Prime surface with "Nitoprime 28"; Maximum 1/2" for vertical applications. Compressive str - 10,150 psi, ASTM C-579. Available in a summer or winter grade; Crack Repair(Horizontal cracks 1/5" to 1/2", ie. saw cuts) Compressive strength - 2760 psi - 3260 psi at 28 days; Creep - under loads, 2-5 times that of conc.
Crack repair (Pressure Injection); Patching; Compressive str - 15,000 psi, ASTM D-695.

D.

TABLE D
ORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROP Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std
Deco Rez 3517	General Polymers (Superior Coatings)	CAN	Epoxy	Liquid	>50		30-35		X	X			See Remarks	3500		D-638						
Deco Rez SRC 3575 LV	General Polymers (Superior Coatings)	CAN	Epoxy	Liquid		75	40		X				See Remarks	Neat >4000		D-638						
Deco Rez SRC 3577 LV	General Polymers (Superior Coatings)	CAN	Epoxy	Liquid		75	25-35		X				See Remarks	Neat >3500	14d	D-638						
Everbond	L&M Construction	USA	Acrylic	Liquid	>50		30		X					600		C-190	825		C-109			
Epopatch	L&M Construction	USA	Epoxy	Plastic	50-150	77	60			X	X		See Remarks	5000		D-638				1250		D-1002
Sealtight Bondlok	W.R. Meadows	CAN	Epoxy	L-P	>40	70 100	30 15		X					400-450 CF			4250					
Perm-Inject	Permagile-Salmon (Form & Build Supply Inc)	CAN	Epoxy	Liquid	>40	73	10		X				See Remarks	>4250		D-638						
PG-2128 LV	Permagile-Salmon (Form & Build Supply Inc)	CAN	Epoxy	Liquid	55-150	77	20		X				See Remarks	>4250		D-638						
PG-2030	Permagile-Salmon (Form & Build Supply)	CAN	Epoxy	Liquid	35-150	77 77	15 45		X				See Remarks	>4200		D-638						
Probond 811	Protex (CONCHEM)	CAN	Epoxy	L-P	Class A <40 Class B 40-60 Class C >60	60 73	36 38	100g 100g	X	X										Class B 3360 2d 3424 14d Class C 3400 2d 3424 14d		
Select Bond GP 2000	Select Products	USA	Epoxy	Liquid		77	20-30		X				13000 D-695	8000		D-638	3200			To Steel 7000 14d		
Select Bond GP3000	Select Products	USA	Epoxy	Plastic		77	40-45		X	X			12000 D-695	9800		D-638	2700			>500 14d		C-882
Select Bond FS 1650 (Type I & Type II)	Select Product	USA	Epoxy	L-P	Type I 68-104 Type II 40-60	77	30		X								>400			CF		

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

CF = Concerte Failure
L-P = Liquid to Plastic Consistency

MECHANICAL PROPERTIES															RESISTANCE									
Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) = Compressive (Et) = Tensile			Coeff. of Thermal Expansion			Creep			Volume Change			Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion		Freeze/Thaw	
psi	age	std	psi	age	std	10E +5 psi	age	std	10E-6 1/F	age	std	Result	age	std	Plastic or Hardened %	age	std							Result	std	cycles	std
						2.0-3.0(Ec)		D-695																		
						Neat 2.0-3.0(Ec) Mortar 3.0(Ec)		D-695 C-579																		
						Neat 2.2(Ec) Mortar 3.0(Ec)		D-695 C-579																		
			725		C-78																					
1250		D-1002	3200		C-293							7.2		C-512										0.29	CRD C-52	
						6.5(Ec)		D-695																		
						6.5(Ec)		D-695																		
Class B 3360 2d 3424 14d Class C 3400 2d 3424 14d									N/A						Passes ASTM C-827 CRD 621										
To Steel 7000 14d >500 14d CF		C-882				4.6(Ec)		D-695																		
						4.6(Ec)		D-695																		

ume Change stic or Hardened % age std	RESISTANCE: Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std	PRODUCT NAME	REMARKS
									Deco Rez 3517	Crack repair (Pressure Injection and gravity feed); Compressive str - 8500 psi, ASTM D-695.
									Deco Rez SRC 3575 LV	This system is available in three consistencies: Deco Rez SRC 3575 LV, SRC 3575, SRC 3575 Gel. SRC3575 LV - patching and adhesive for pressure injection SRC 3575 - patching and bonding conc, pressure injecting SRC 3575 Gel - paste for vertical and overhead repairs. Neat: Compressive str - 10,000 psi, ASTM D-695. Mortar: Compressive str - 14,000 psi, ASTM C-579.
									Deco Rez SRC 3577 LV	This system is available in three consistencies: Deco Rez SRC 3577 LV, SRC 3577, SRC 3577 Gel. This system is designed for low modulus of elasticity and stress relief properties with variations in temp. SRC 3577 LV - patching, pressure injection applications SRC 3577 - binder for use with skid resistant overlays, etc. SRC 3577 Gel - paste for vertical or overhead applications. Neat: Compressive str - >9000 psi, ASTM D-695 Mortar: Compressive str - >8000 psi, ASTM C-579
							0.29 CRD C-52		Everbond	Crack repair (used as an additive in Portland cement in filling and repairing cement cracks); Patching.
									Epopatch	Crack repair (foundation cracks); Patching. Compressive str - 12,000 psi, ASTM D-695.
									Sealtight Bondlok	Crack repair; Patching, bonding.
									Perm-Inject	Crack repair (pressure Injection). Compressive str - 10,000 psi, ASTM D-695.
									PG-2128 LV	Crack repair (grouting non-moving cracks); Patching; Compressive str - 10,000 psi, ASTM D-695.
									PG-2030	Crack repair; Bonding. Compressive str - 10,500 psi, ASTM D-695.
es ASTM C-827 CRD 621									Probond 811	This system (811, 812, 813) conforms to ASTM C-881 Type I (ie Bonding hardened conc to hardened conc); Also for use in pressure injection, gravity feed etc. The system is available in three grades with a corresponding temp. range (°F) for each grade (Class A - <40, Class B 40-60, Class C >60) Probond 811 - Grade 1 for appl. by spray, roller, broom injection etc. Crack width 0.005" to 0.25" Probond 812 - Grade 2, for brush, broom, squeeze application, crack width >0.25" ; Bond strength 3610 psi (2 days) 2967 psi (14 days) Probond 813 - Grade 3, for trowel application, Bond Str. - 3600 psi (2 days) 2359 psi (14 days)
									Select Bond GP 2000	Crack Repair (Pressure Injection); Bonding
									Select Bond GP3000	Crack Repair; Bonding, Patching
									Select Bond FS 1650	Crack Repair; Bonding

E.

TABLE E
ORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Da (1)
Denepox 40	De Neef Chimie	Belgium	Epoxy	Fluid	77	+50	120	2.5 gal	X	
Flex 44	De Neef Chimie	Belgium	P.U.Grout	Fluid	70	0-100		0.5 gal	X	
Tacss 020 NF	De Neef Chimie	Belgium	P.U.Grout	Fluid	75	0-100		0.5 gal	X	
Taccs 025 NF	De Neef America	USA	Polyure-thane	Liquid	50-86					
XLV	Prime Resins Inc		Epoxy	Fluid	40-100	77	18	3 fl.oz.	X	
XLV-35	Prime Resins Inc		Epoxy	Fluid	40-100	77	25	3 fl.oz.	X	
IG-R	Prime Resins Inc		Epoxy	Fluid	40-100	77	14	3 fl.oz.	X	
IG-25	Prime Resins Inc		Epoxy	Fluid	40-100	77	40	3 fl.oz.	X	
IG-50	Prime Resins Inc		Epoxy	Fluid	40-100	77	45	3 fl.oz.	X	
Evapox Inj. Resin	E-Poxy Indust.	USA	Resin-Amine		0-100	77	35	200 g	X	
Aquata Poxy -gel	American Chemical	CAN.	Epoxy	Plastic	-55 +221	77	40	4 oz.	X	
Injection Resin 121	Chemque Canada	CAN	Epoxy	Liquid	40-95	72	20-22	100 g	X	
Sonocrete	Sonneborn	USA	Acrylic Latex	Liquid	>40	75	30		X	
Epolith Patcher	Sonneborn	USA	Epoxy	Plastic	>60	75	120			X
Injection Resin #2	Speciality Compounds	USA	Epoxy	Liquid	>0	77	12-15	100g	X	X
Flexible Resin #3-F	Speciality Compounds	USA	Epoxy	Liquid		77	90	100g	X	X
Epoxy Bonder #6	Specility Compounds	USA	Epoxy	Plastic		77	20-25	100g	X	
Urethane Grout W.G. (Unfilled)	Sternson	CAN	Urethane	Liquid	(-31)-41	-31 -4 41	10-12 5 <1	2.2 L 2.2 L 2.2 L	X	
Urethane Grout S.G. (Unfilled)	Sternson	CAN	Urethane	Liquid	>14	14 50 90	15-20 7-10 2-4	2.2 L 2.2 L 2.2 L	X	
Tram Epoxy S	Tramco	CAN	Epoxy	Plastic	>41	68 95	45 20		X	
Tram Epoxy LV	Tramco	CAN	Epoxy	Liquid	>41	41 68 104	100 20 5		X	
TramEpoxy Grout-40	Tramco	CAN	Epoxy	Fluid	41-86	77	120	1 Kg	X	
TramEpoxy - LV	Tramco	CAN	Epoxy	Liquid	41-86	77	35	150 g	X	X

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) Federal Spec. MMM D350a

L = Litres
DC = Dry Concrete
WC = Wet Concrete

| T | | | | MECHANICAL PROPERTIES | | | |

Elasticity Passive		Coeff. of Thermal Expansion 10E-6 /F			Creep			Volume Change Plastic or Hardened			RESISTANCE						Abrasion		Freeze/Thaw		PRODUCT NAME	REMARKS
	std		age	std	Result	age	std	%	age	std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Result	std	cycles	std		
											GOOD	GOOD	GOOD	BAD	GOOD	GOOD					Denepox 40	Structural; Repair cracks by injection
											GOOD	GOOD	GOOD	GOOD	EXCEL	GOOD					Flex 44	Sealing leakages through joints, moving
											GOOD	GOOD	GOOD	GOOD	EXCEL	GOOD					Tacss 020 NF	Sealing leakages through voids, cracks, Water Reactive.
																					Tacss 025 NF	Crack Repair; Pressure Injection; Seal in three types; Compressive Str. - 5
d	D-638	80	7 d	D-696				-2.1	7 d		GOOD	GOOD	EXCEL	GOOD	0.15 %				5, pass	C-884	XLV	Extremely low viscosity injection Shore Hardness = 80-D
d	D-638	100	7 d	D-696				-2.0	7 d		GOOD	GOOD	EXCEL	GOOD	0.30 %				5, pass	C-884	XLV-35	Extremely low viscosity injection Shore Hardness = 70-D
d	D-638	70	7 d	D-696				-2.2	7 d		GOOD	GOOD	EXCEL	GOOD	0.10 %				5, pass	C-884	IG-R	Rigid injection Shore Hardness = 85-D
d	D-638	85	7 d	D-696				-2.1	7 d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, pass	C-884	IG-25	25 % Elongation injection Shore Hardness = 79-D
d	D-638	110	7 d	D-696				-2.0	7 d		GOOD	GOOD	EXCEL	GOOD	0.25 %				5, pass	C-884	IG-50	50 % Elongation injection Shore Hardness = 60-D
d	D-695										EXCEL	EXCEL	EXCEL	GOOD	EXCEL						Evapox Inj. Resin	Concrete crack injection
		34.4									POOR	EXCEL	EXCEL	GOOD	EXCEL	EXCEL					Aquata Poxy -gel	Sealing underwater cracks; used as anch Patching.
																					Injection Resin 121	Epoxy injection to structurally repair
																					Sonocrete	Crack Repair (static crack < 1/8" to 3
																					Epolith Patcher	Crack Repair (filling cracks); Patching ture -40F to 180F.; Compressive Str.
																					Injection Resin #2	Crack Repair (Pressure Injection); Damp Dry surfaces >0 F;
																					Flexible Resin #3-F	Crack Repair (Injection into cracks whe
																					Epoxy Bonder #6	Crack Repair (sealing before injection)
																					Urethane Grout W.G. (Unfilled)	Crack Repair; Grouting; Winter Grade.
																					Urethane Grout S.G. (Unfilled)	Crack Repair; Grouting; Summer Grade.
											EXCEL	G-E	GOOD		GOOD						Trem Epoxy 5	Crack Repair; Patching; Can be applied chemicals; Compressive Str. - 10150 p
																					Trem Epoxy LV	Crack Repair (Pressure Injection, Gravi 0.01" to 0.4"); Used in areas where h chemical resistance is reqd.
		32.8	28 d					-0.009	28 d	C-531	A	A	A	B	A						TremEpoxy Grout-40	Free flow epoxy grout.
											A	A	A	A	A						TremEpoxy - LV	Moisture insensitive epoxy injection re

A - Intact, Unaffected
B - Intact, Abrades Readily
C - Intact, Softened to Rubber Consistency

T NAME	REMARKS
D	Structural; Repair cracks by injection or gravity feeding
	Sealing leakages through joints, moving cracks
NF	Sealing leakages through voids, cracks, soil; Water Reactive.
NF	Crack Repair; Pressure Injection; Seal water leaks; Available in three types; Compressive Str. - 550 psi.
	Extremely low viscosity injection Shore Hardness = 80-D Extremely low viscosity injection Shore Hardness = 70-D Rigid injection Shore Hardness = 85-D 25 % Elongation injection Shore Hardness = 79-D 50 % Elongation injection Shore Hardness = 60-D
j. Resin	Concrete crack injection
xy -gel	Sealing underwater cracks; used as anchoring material; Patching.
Resin 121	Epoxy injection to structurally repair cracks in concrete.
	Crack Repair (static crack < 1/8" to 3/4"), Bonding; Patching;
cher	Crack Repair (filling cracks); Patching; service temperature -40F to 180F.; Compressive Str. 9000 to 10000 psi
esin #2	Crack Repair (Pressure Injection); Damp surfaces >32F, Dry surfaces >0 F;
sin #3-F	Crack Repair (Injection into cracks where movment is expected)
r #6	Crack Repair (sealing before injection); Bonding.
out lled)	Crack Repair; Grouting; Winter Grade.
out illed)	Crack Repair; Grouting; Summer Grade.
S	Crack Repair; Patching; Can be applied in areas subject to chemicals; Compressive Str. - 10150 psi ASTM C-579-82
LV	Crack Repair (Pressure Injection, Gravity feed, width 0.01" to 0.4"); Used in areas where high strength and chemical resistance is reqd.
Grout-40	Free flow epoxy grout.
- LV	Moisture insensitive epoxy injection resin.

F.

TABLE F
ORGANIC MATERIAL - CRACK REPAIR

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	MECHANICAL P Bond Strength psi	age	std
Febset Injection Grout #6	F.E.B.		Epoxy	Liquid	41-113	77	50	1 L			X		10,100									
Sikadur 31	Sika Canada Inc.	CAN	Epoxy	Paste	-50 +180	73	35	0.5 L	X	X			11,024 D-695	3,626	14 d	D-638	2,756	14 d	D-732			
Sikadur 36 Marine Gel	Sika Canada Inc.	CAN	Epoxy	Gel	-50 +180	73	18-20 -neat	0.5 L	X	X	X	1,160 D-695	4,932 D-695	1,450 -neat 1,015 -mortar	14 d	D-638	870 -neat 1,450 -mortar	14 d	D-638	2,321 3,046	2 d 14 d	C-882
Sikadur 53-ST-1	Sika Canada Inc.	CAN	Epoxy	Liquid	-50 +180	73	25	0.5 L	X	X	X		10,008 28 d	4,496	14 d	D-638	4,206	14 d	D-638	1,741 2,756	2 d 14 d	C-882
Sikadur 52	Sika Canada Inc.	CAN	Epoxy	Liquid	-50 +180	73	20-25	0.5 L	X	X	X		8,848 28 d	5,367	14 d	D-638	4,351	14 d	D-638	- Underwater		
Sikadur 33	Sika Canada Inc.	CAN	Epoxy	Paste	-50 +180	73	25	0.5 L	X	X		5,657 D-695	6,237 D-695	2,321	24 hr	D-638	2,901	14 hr	D-732			
Sikadur 51 NS	Sika Canada Inc.	CAN	Epoxy	Non-Sag	-50 +180	73	135	0.5 L	X	X				595	14 d	D-638 -type IV	798	14 d	D-638	798 450	2d Dry 14 d Moist	C-88
Sikadur 51 SL	Sika Canada Inc.	CAN	Epoxy	Self-Level.	-50 +180	73	120	0.5 L	X	X				551	14 d	D-638 -type IV	696	14 d	D-638	696 406	2d Dry 14 d Moist	C-88
Sikadur Hi-Mod	Sika Canada Inc.	CAN	Epoxy	Liquid	-50 +180	73	30	0.5 L	X	X		3,916 D-695	8,993 D-695	4,787	14 dy	D-638	5,947	14 d	D-732	1,886	14 d	C-882
Sikadur Hi-Mod LV	Sika Canada Inc.	CAN	Epoxy	Liquid	-50 +180	73	25	0.5 L	X	X		6,817 D-695	10,733 D-695	6,237	14 dy	D-638	5,077	14 d	D-732	2,756 2,756	2d Dry 14d Damp	C-88

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

L - Litres
CF - Concrete Failure
F-P - Fair to Poor

MECHANICAL PROPERTIES																									RESISTANCE									
ength			Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) = Compressive (Et) = Tensile			Coeff. of Thermal Expansion			Creep			Volume Change Plastic or Hardened			Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion		Freez
ge	std		psi	age	std	psi	age	std	10E +5 psi	age	std	10E-6 /F	age	std	Result	age	std	%	age	std							Result	std	cycles
						9,425	7 d		2.9	14 d																			
d	D-732					5,077	14 d	D-790	7.0	28 d	D-695									FAIR	FAIR		F-P	GOOD				
d	D-638	2,321 3,046	2 d 14 d	C-882		14 d	D-790			28 d	D-695													GOOD				
eat ortar						2,466 3,046	-neat -mortar		5.2 10.0	-neat -mortar																			
d	D-638	1,741 2,756	2 d 14 d - Underwater	C-882		6,817	14 d	D-790	5.2	28 d	D-695													GOOD				
d	D-638								2.6	28 d	D-695									FAIR	FAIR		F-P	GOOD				
hr	D-732					4,061	24 hr	D-790	4.9	28 d	D-695									FAIR	FAIR			GOOD				
d	D-638	798 450	2d Dry 14 d Moist	C-882					13.1	14 d	D-638												POOR	Do not use under Constant immersion				
d	D-638	696 406	2d Dry 14 d Moist	C-882					8.7	14 d	D-638	4.06											POOR	Do not use under Constant immersion				
d	D-732	1,886	14 d	C-882		7,397	14 d	D-790	4.9	28 d	D-695									FAIR	FAIR		F-P	GOOD				
d	D-732	2,756 2,756	2d Dry 14d Damp	C-882		13,925	14 d	D-790	4.1	28 d	D-695									FAIR	FAIR		F-P	GOOD				

...e Change ...tic or Hardened ...age std	RESISTANCE									PRODUCT NAME	REMARKS
	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std		
										Febset Injection Grout #6	Injection gun/wall flanges; Suitable for crack injection.
	FAIR	FAIR		F-P	GOOD					Sikadur 31	Gap filling adhesive, sealing cracks for injection; Mixed with sand for patching. Compressive Str. 11020 psi - 28 d D-695
					GOOD					Sikadur 36 Marine Gel	Sealing up underwater cracks for injection purposes; Underwater repairs only. Compressive Str. 28 d D-695 : Neat = 1240 psi Mortar = 1130 psi
					GOOD					Sikadur 53-ST-1	Crack repair underwater by gravity or injection. Compressive Str. 1000 psi - 28 d D-695
	FAIR	FAIR		F-P	GOOD					Sikadur 52	Crack injection; Sealing slabs (inside). Compressive Str. 8850 psi - 28 d D-695
	FAIR	FAIR			GOOD					Sikadur 33	Seal cracks prior to injection; Fast setting repairs; All horiz., vert. and overhead in the dry.
				POOR	Do not use under Constant immersion					Sikadur 51 NS	To seal construction and control joints non-moving; As an adhesive (Flexible).
				POOR	Do not use under Constant immersion					Sikadur 51 SL	To seal construction and control joints non-moving, horiz., in slabs etc.; As an adhesive.
	FAIR	FAIR		F-P	GOOD					Sikadur Hi-Mod	Crack repair; Bonding; Adhesive; Patching mortar; Potting compound; Overlays.
	FAIR	FAIR		F-P	GOOD					Sikadur Hi-Mod LV	Crack injection; Sealing slabs (inside); Overlays with sand; Hi-Modulus mortar topping. Compressive Str. 11750 psi Above and underwater use.

G.

TABLE G
INORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min.	Samp Siz
Horn 240	AC Horn	USA	Magnesia Phosphate blend conc.	Plastic	30-90	30 70 90	75 7-10 4-6	
Surface Magic	AC Horn	USA	Polymer Mod. conc	L-P	>40		<30	
Bonsal Instant H.C.	Bonsal	USA	Hydraulic Cement	P-S			3-6	
Fast Set Cement Mix	Bonsal	USA	Cement	L-P	>40		20-30	
Vinyl Conc. Patcher	Bonsal	USA	Cement	L-P	50-100		20-30	
Fast Setting Cement	Burk	USA	Cement	Plastic	>32		20	
Rapidex	Canada Cement	CAN	Cement	Plastic	28-95		15-45	
10-20 Calroc GPR	Celtite	USA	Polymer Mod. conc	Plastic	41-100		30	
10-22 Calroc LWR	Celtite	USA	Polymer Mod. conc	Plastic	41-100		30	
10-24 Calroc HDR	Celtite	USA	Polymer Mod cement	Plastic	41-100		30	
10-35 Calroc P	Celtite	USA	Hydraulic Cement	L-P	41-100		40	
10-45 Poly Plug	Celtite	USA	Polymer Mod Cement	Plastic	41-100		6	
10-50 Hi-Flow	Celtite	USA	Cement	L-P	41-100		180	
10-60 Calroc RPM	Celtite	USA	Cement	Plastic	41-100		16(C-266)	
All-Crete 5min Set	Dayton Superior	USA	Cement	Plastic	>-20		3(C-266)	
All-Crete 20min Set	Dayton Superior	USA	Cement	Plastic	>-20		10(C-266)	
Water Stop	Dayton Superior	USA	Hyderulic Cement	L-P	>35		1.5(C-266)	
Flo - Top	The Euclid Co.	USA	Cement	Liquid	>40		45	
K - Ment	The Euclid Co.	USA	Hydraulic Cement	L-P	>40		(C-191Mod) 35-40	
Euco Poly-Patch	The Euclid Co.	USA	Cement	Plastic	50-100		45	
FX - 210	Fox Industries	USA	Magnesium Phosphate conc	Plastic	>32	70	15	
FX-927	Fox Industries	USA	Cement	Plastic	50-70	72	10	
FX-928	Fox Industries	USA	Cement	Plastic	70-80	72	17	
FX-929	Fox Industries	USA	Cement	Plastic	>80	72	30	
FX-922 Plug & Fast Set	Fox Industries	USA	Cement	Plastic		73	3-5	
Renderoc S	Fosroc	CAN	Polymer Mod cement	Plastic	41-90		60-120	
Renderoc HB	Fosroc	CAN	Polymer Mod cement	Plastic	41-90		180-240	
Nitoflor Patroc	Fosroc	CAN	Cement	Plastic	41-90	50 68	35 15	

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "H" indicates that the product is recommended by the manufacturer for use under this condition.
(2) CRD C-227
(3) Slant Shear Bond to BSS 6319 Part 4

DF -
H/R -

ERIALS

Time	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES: Compressive Strength (PSI) 1 Day (std)	Compressive Strength (PSI) 7 Day (std)	Tensile Strength psi age std	Shear Strength psi age std	Bond Strength psi age std	Flexural Strength psi age std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+6 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volum Plastic %
		X			3700 C-109	5000 C-109				1000 28d C-293				
			X		1985	4775	188 1d 451 7d							
			X		1800	See Remarks	200 1d 300 7d 360 28d							
				X	3000 C-109	5000 C-109				500 7d				
				X	2500 C-387	See Remarks	300 7d C-387	325 28d C-358						
		X			3315 C-109	4900 C-109			>100					
			X	X	4000	4500				800 1d				-0.07
		X	X		1160 C-109	3625 C-109	285 C-190			1400 C-348				
		X	X		435 C-109	2175 C-109	115 C-190			870 C-348				
		X	X		4350 C-109	7250 C-109	594 C-190			2175 C-109				
		X	X		5000 C-109									
		X	X	X	2300 C-109	4500 C-109	415 7d C-190							
		X	X		2800 7058	6050 (2) 8090				600 C-78				+0.03 +0.07
				X	5410 C-109	8320 C-109								
				X	4830 C-109	7100 C-109								
				X	1870 C-109	3650 C-109								
		X				3300 C-109 & C-349				645 C-348Mod				0.04-0.09
			X	X		6500 C-109								
		X			6400 (Mod)	7000 (Mod)								
		X			5000 C-109	6000 C-109				1000 3d C-78				
		X			5000 C-109	5900 C-109				850 3d C-78				
		X			3500 C-109	4200 C-109				500 3d C-78				
		X			4200 C-109	5800 C-109								
			X	X			507 C-190 1" Brick	3335 BSS-2782	3335 AASHTO T-237	1387	36.3	5.0	See Remarks	Hardened +0.01 wet -0.03 dry
			X	X			500 C-190 1" Brick	1885	3335 AASHTO T-237	943	27.6	4.1	See Remarks	Plastic +0.04 Hardened +0.02
			X	X	8700	9427	943	3625 BSS-2782	6526 (3)	1231	42.1	4.4	See Remarks	

DF - Durability Factor
H/R - Not Recomended

L-P - Liquid to Plastic
P-S - Plastic to Slurry
F-G - Fair to Good

Elasticity Compressive Str. age	std	Coeff. of Thermal Expansion 10E-6 /F age	std	Creep Result age	std	Volume Change Plastic or Hardened % age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
																300 D.F. 64.7	C-666	Horn 240	
																		Surface Magic	Grout; Patching; Bonding; Chemical Resistant.
																		Bonsal Instant H.C.	Patching; Underwater repair; Repairs Compressive Str. - 5000 psi 28d
																		Fast Set Cement Mix	Underwater repair; Patching;
																		Vinyl Conc. Patcher	Patching; Compressive 6500 28d
						-0.07	28d	GOOD	GOOD									Fast Setting Cement	Quick Patching.
								N/R	GOOD	GOOD	GOOD	GOOD		F-G				Rapidex	
								N/R	GOOD	FAIR	GOOD	GOOD		FAIR				10-20 Celroc GPR	Vertical applications.
								N/R	GOOD	GOOD	GOOD	GOOD		GOOD				10-22 Celroc LWR	Overhead application.
								N/R	GOOD	GOOD	GOOD	GOOD		GOOD				10-24 Celroc HDR	Horizontal applications.
								FAIR	GOOD	GOOD	GOOD	GOOD		GOOD				10-35 Celroc P	Non-shrink Grout.
						+0.03	CRD C-621	N/R	GOOD	GOOD	GOOD	GOOD		GOOD				10-45 Poly Plug	Stop water leaks.
						+0.07	C-157	FAIR	GOOD	GOOD	GOOD	GOOD		GOOD		300 D.F. 82.5	C-666 Method A	10-50 Hi-Flow 10-60 Celroc RPM	Structural grouting. Rapid Patch mortar.
																		All-Crete 5min Set	Patching; Large crack repairs; Underw
																		All-Crete 20min Set	Patching; Large crack repairs; Underw
																		Water Stop	Patching (Water leaks); Crack Repair;
						0.04-0.09	C-596 & C-490											Flo - Top	Patching;
																		K - Ment	Patching; Crack Repair.
																		Euco Poly-Patch	Patching; Crack Repair.
								POOR										FX - 210	Patching; Placement down to 28 deg. successfu
								POOR										FX-927	Patching;
								POOR										FX-928	Patching;
																		FX-929	Patching;
																		FX-922 Plug & Fast Set	Patching;
	5.0	See Remarks				Hardened +0.01 wet -0.03 dry	C-157 C-157									50 No wt loss	C-672	Renderoc S	Patching (Horiz. & Vert.); Compressiv Freeze/Thaw - 1.2% wt. loss at 50 c
	4.1	See Remarks				Plastic +0.04 Hardened +0.02	C-827 CRD C-621									50 No wt loss	C-672	Renderoc HB	Patching (Vert. & Overhead); Compress Freeze/Thaw - 1.0% wt. loss at 50 c
	4.4	See Remarks														50 No wt loss	C-672	Nitoflor Patroc	Patching; Compressive Str. - 10150 at

CT NAME	REMARKS
gic	Grout; Patching; Bonding; Chemical Resistant.
tant H.C.	Patching; Underwater repair; Repairs in sub-freezing temp. Compressive Str. - 5000 psi 28d
Cement Mix	Underwater repair; Patching;
c. Patcher	Patching; Compressive 6500 28d
ing Cement	Quick Patching.
roc GPR	Vertical applications.
roc LWR	Overhead application.
roc HDR	Horizontal applications.
roc P	Non-shrink Grout.
Plug	Stop water leaks.
Flow	Structural grouting.
roc RPM	Rapid Patch mortar.
5min Set	Patching; Large crack repairs; Underwater application;
20min Set	Patching; Large crack repairs; Underwater applic.
	Patching (Water leaks); Crack Repair; Underwater application.
	Patching;
	Patching; Crack Repair.
-Patch	Patching; Crack Repair.
	Patching; Placement down to 28 deg. successful.
	Patching;
	Patching;
	Patching;
ug & Fast	Patching;
S	Patching (Horiz. & Vert.); Compressive Str. >6500 at 28d; Freeze/Thaw - 1.2% wt. loss at 50 cycles (NYS DOT 216)
MB	Patching (Vert. & Overhead); Compressive Str. >5000 at 28d; Freeze/Thaw - 1.0% wt. loss at 50 cycles (NYS DOT 216)
Patroc	Patching; Compressive Str. - 10150 at 28d;

H.

TABLE H
INORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min.	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROP Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std	F
Tapecrete	F.R.C.Composites	CAN	Polymer Mod cement	L-P	>45					X	X		See Remarks	7000						650			
Duro-Crete (Winter Grade)	Intrusion Prepakt	CAN	Cement	Stiff	32-37		5-8			X	X	2000 C-109	5500 C-109	200		C-190				1480	7d		
SUPER-TOP	Intrusion Prepakt	CAN	Polymer Mod cement	Plastic	50-90		60			X			See Remarks	500	28d	C-190				500			
Duratop	L&M Construction	USA	Polymer Mod cement	L-P	>45	70	45			X	X	2500	5200							>400		C-234	
Durapatch	L&M Construction	USA	Cement	Plastic		70	15(C-266)			X	X	2800 C-109		650		C-109							
Durapatch HiWay	L&M Construction	USA	Cement	Plastic		70	15(C-266)			X	X	6100 C-109		750		C-109							
Embeco 411 & 411A	Master Builders	CAN	Cement	Plastic	68	70	210				X	4200	6530				2200	7d					
Set - 45	Master Builders	CAN	Magnesium Phosphate Conc	L-S	>32	32 72 90	60 16 8		X			6400	7200							>1000			
Masterpatch 20	Master Builders	CAN	Cement	Plastic	40-90	70	45					3800	7800				2100 2600	7d 28d		1500	28d	ASTM C882	
Por - Roc	Miniwax (National Lab.)	CAN	Cement	Liquid		70	16			X		5340 air dry	6915 air dry 9254 wet							4900-6800			
Nbec Non-shrink GT	Nbec Corporation	USA	Cement	L-P			>120				X	5000 C-109											
Pro Patch Std. & Summer Grade	Protex (ConChem)	CAN	Magnesium Phosphate Conc	Plastic	40-86		12-15		X			7000 C-109								1600	1d	C-882	
Sono Patch	Sonneborn	USA	Polymer Mod cement	Plastic	>32		20			X		3000 C-109	5800 C-109										
Sono Plug	Sonneborn	USA	Hydraulic cement	P-S			3-5				X												
M-Bed Standard O.H.	Sternson	CAN	Cement	L-S	41-86		30-60			X		2175-5800	5080-7980										9
M-Bed Super flow (Flowable)	Sternson	CAN	Cement	L-S	41-86	50 72	450 390			X		5650	8700										7
M-Bed Fibre Grout	Sternson	CAN	Cement	L-S	40-86	72	30-60			X		3625-5075	7250-8700	290-580	28 d		870-145	28	C-882	Similar to concrete			8
Surfacrete	Sternson	CAN	Latex Additive		40-86	72	30-45			X										Similar to concrete			8
Speed Crete (Red Line)	Tamms (Milne Agents)	CAN	Cement	Plastic			5-10			X		>2500	4300										
Unsanded Expanding	Target Products	CAN	Cement	L-P	50-75				X				5890 CRD C621										
Fast Set Patch Conc.	Target Products	CAN	Cement	P-S	41-95	68	90		X				5800										

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) CRD C-227

DF - Durability Factor
L-P - Liquid to Plastic
L-S - Liquid to Slurry
P-S - Plastic to Slurry

MECHANICAL PROPERTIES															RESISTANCE								
Strength		Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) - Compressive (Et) - Tensile			Coeff. of Thermal Expansion			Creep			Volume Change			Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion		Freeze/
ge	std	psi	age	std	psi	age	std	10E +5 psi	age	std	10E-6 /F	age	std	Result	age	std	Plastic or Hardened %	age	std							Result	std	cycles
		650																		GOOD	EXCEL							
		1480	7d		500		C-348																					
		500			1300		C-348													GOOD	GOOD	GOOD						
		>400		C-234	1100	7d	C-580	45.0									+0.0	7d	CRD C-621									
					730	1d	C-78										+0.0	7d	CRD C-621									
					1120	1d	C-78																					
					1260	7d	C-78																					
d					770	7d		45.0	7d																			See Rem
		>1000			1000	1d	C-78 Mod				7.6						0.015	14d	C-157 Mod									
					1134	7d	C-78 Mod																					
d		1500	28d	ASTM	850	7d		5.0 x 10E+6	7d	C-469										NO	YES	YES	YES	YES	YES			300
8d				C882	930	28d	C-78	5.0 x 10E+6	28d																			DF-97
		4900-6800																										
		1600	1d	C-882																					GOOD	GOOD		
					870-1450			0.5									Plastic +2.0											
					725-870												< 0.4 expansion											
28	C-882	Similar to concrete			870-1450		28 d				Similar to concrete						< 0.4 %			NO	NO	NO	NO	YES	YES			
		Similar to concrete			870-1160		28 d				Similar to concrete													YES	YES			
																												300
																												D.F.=69
																	0.24 exp 7d											
																	0.02 exp.		CRD C-621									

Volume Change				RESISTANCE						PRODUCT NAME	REMARKS
tic or Hardened % age std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std			
	GOOD	EXCEL								Tapecrete	Bonding; Patching; Crack Repair;withstand movement up to 0.02" Compressive Str. - 10500 psi.
	GOOD	GOOD	GOOD							Duro-Crete (Winter Grade) SUPER-TOP	Patching; Available in three formulations: Summer Grade - Above or underwater applications; >50F Winter Grade - Above or underwater applications; will harden below 32F however safer to bring area to 32F Architectural Grade - Where a whiter colour is reqd. Can be used in Summer and Winter. Setting Time based on ASTM C-807-75 Patching; Available in three consistencies: SUPER-TOP 400 - Rapid hardening SUPER-TOP 1200 - Normal hardening SUPER-TOP "OV" - Overhead and Vertical Repairs
0 7d CRD C-621 0 7d CRD C-621										Duratop Durapatch Durapatch HiWay	Patching Patching Patching
015 14d C-157 Mod	NO	YES	YES	YES	YES	YES		See Remarks 300 C666 DF-97 A		Embaco 411 & 411A Set - 45 Masterpatch 20	Patching; 411A (Air entrained), Freeze/Thaw - Water 300 cycles D.F.= 99.7 - 5% NaCl 300 cycles D.F.= 98.3 - 5% CaCl 300 cycles D.F.= 87 Patching; Absorption Specimen 2.97% - Testing - 48 hours Salt Scaling 0.160 kg/m2 - 50 cycles F/T
										Por - Roc	Patching; Crack Repair
										Nbec Non-shrink GT	Patching
						GOOD	GOOD			Pro Patch Std. & Summer Grade	Patching;
										Sono Patch Sono Plug	Patching; Underwater repairs; Patching (Water leaks); Sets under water;
atic +2.0 .4 expansion .4 %	NO	NO	NO	NO	YES YES	YES YES				M-Bed Standard M-Bed Super flow M-Bed Fibre Grout Surfacrete	Grouting Grouting; Available in three consistencies, Fluid, Flowable Dry-pack; Improves freeze/thaw performance and resistance to de-icing scaling. Meets MTC spec. for bridge decks. Compressive strength 4060 psi at 28 d
								300 C-290 D.F.=69		Speed Crete (Red Line)	Available in three formulations, < 3/4" use bonding agent, RED LINE - General purpose patching for bridges, highway etc WHITE LINE - General purpose patching, grouting, etc. BLUE LINE - Above & Underwater Applications,eg. Sea walls
4 exp 7d 2 exp. CRD C-621										Unsanded Expanding Fast Set Patch Conc.	Expanding Grout; Grouting; Crack Repair Patching.

I.

TABLE I
INORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors)		Generic Type	PLACEMENT				
				Consistency	Temp. Range Deg F	Working Time		
	NAME	Origin				Temp. Deg F	Time min.	Sample Size
Road Patch	Thoro System	CAN	Cement	Plastic	>40		6-12	
Thorite	Thoro System	CAN	Cement	L-P	>40		5-10	
Thoro Patch	Thoro System	CAN	Cement & Acrylic	Plastic	>40		<20	
Water Plug	Thoro System	CAN	Cement	P-S	(-40)-100	70	3-5	
Five Star Grout	U.S. Grout (Dabro Const. Spec)	CAN	Cement	L-S	40-90	70	75	
Gemcrete and Gemcrete CR	Gemite Unique Products Inc.	CAN.	Fibre - Reinfirced Mortar (cement)		40	90	60	
Gem-Top	Gemite Unique Products Inc.	CAN.	Fibre - Reinfirced Mortar (cement)		40	90	60	
MSA (F)	Gemite Unique Products Inc.	CAN.	Concrete Additive					
Expan Premix	F.E.B.		Cement	Mortar	41-113	68	45	25 Kg
Expan Premix - flowable grade	F.E.B.		Cement	Flowable Mortar	41-113	68	25	25 Kg
Feb-Set 45	F.E.B.		Magnesium-Phosphate Cement	Mortar	-4-113	71	15	25 Kg
Trem Tech V	Tremco	CAN	Polymer Mod cement	Plastic	>45			
Trem Tech Gal	Tremco	CAN	Polymer Mod cement	Plastic	>45			
TremPlug	Tremco	CAN	Cement	Paste	41 +	77	1	300 g
TremPatch - F	Tremco	CAN	Cement	Paste	41 +	77	2-3	300 g
TremPatch - S	Tremco	CAN	Cement	Paste	41 +	77	15-20	300 g
TremFlor -Emerundum	Tremco	CAN	Ferro - Silicon - Iron	Powder	41 +	77	120	25 Kg
TremFlor - Duramet	Tremco	CAN	Metallic	Powder	41 +	77	120	25 Kg

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

L-P - Liqu
L-S - Liqu
P-S - Plas

ND BONDING MATERIALS

Temp. deg F	Working Time: Time min.	Sample Size	PLACEMENT: Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES: Compressive Strength (PSI) 1 Day (std)	Compressive Strength (PSI) 7 Day (std)	Tensile Strength psi age std	Shear Strength psi age std	Bond Strength psi age std	Flexural Strength psi age std	Modulus of Elasticity (Ec - Compressive, Et - Tensile) 10E+6 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std
	6-12		X	X		2210 C-109	5000 C-109	304 7d C-190			720 7d C-348			
	5-10			X		812 C-109	3910 C-109							
	<20		X				See Remarks	1055			1805			
70	3-5			X	X	2917	4083	291 7d					7.9	
70	75			X	X		5000 C-109							
90	60				X	- 2 days - 4,500-4,900 (2 in.cubes)	6,000-6,500 C-109	500-700 28 d		150-300 28 d - 4 in.core - direct tension pull off test	1,500-1,900 28 d C-27-40	20-29 28 d C-27-40	6 28 d	
90	60				X	- 28 days - 5,000-5,500 C-109				300-400 - 4 in.core - direct tension pull off test	800-1,000 C-27-40			Moderate
60	45	25 Kg			X	4,780	9,400							
68	25	25 Kg			X	6,810	10,100							
71	15	25 Kg			X	5,900	8,990			1,015 7 d	1,015 7 d			
			X	X			See Remarks	650 C-190			1450 C-348		Similar to conc.	
			X	X				510 C-190			870 C-438		Similar to conc.	
77	1	300 g	X	X		1,190 C-109	1,280 C-109							
77	2-3	300 g	X	X		1,940 C-109	4,800 C-109							
77	15-20	300 g	X	X		2,122 C-109	4,810 C-109							
77	120	25 Kg		X		5,500 C-109	10,000 C-109	717 28 d			2,490 28 d		7.5 28 d	
77	120	25 Kg		X		9,000 C-109	11,500 C-109	883 28 d			2,280 7 d		7.5 28 d	

cturer.
cturer

L-P - Liquid to Plastic
L-S - Liquid to Slurry
P-S - Plastic to Slurry

lus of Elasticity - Compressive - Tensile 5 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volume Change Plastic or Hardened % age std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std	PRODUCT NAME	RE
												Road Patch	Patching
												Thorite Thoro Patch	Patching; Crack Repair; Patching; Compressive Strengt
	7.9											Water Plug	Patching (Stopping water leak
												Five Star Grout	Patching; Grouting etc Other formulations are avai applications ie: - Resist chemical - Low Heat of Hyd - Hot weather, Hi resistance - Rapid Str. Gain (4000 psi - Hydraulic cement; Rapid S
-29 28 d C-27-40	6 28 d		-0.1 28 d C-596	POOR GOOD (CR Type)	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	2.75 BS-812	300 C-666-A	Gemcrete (CR)	Mixed and applied as a cement
		Moderate	-0.1 28 d C-596	GOOD	EXCEL	EXCEL	GOOD	GOOD	EXCEL		300 C-666-A	Gem-Top	Mixed and applied as a cement
												MSQ (F)	Additive based on condensed s water permeability of concr
				NR	S	S	S	R	R			Expan Premix	Trowel - Good tamping; When c as a primer.
				NR	S	S	S	R	R			Expan Premix - flowable grade	Grouting machinery; When rest
				S	S	S	S	R	R		144 -922 Dynamic Modulus	Fab-Set 45	Trowel - Good compaction; Pla carefully.
	Similar to conc.									EXCEL		Tram Tech V	Patching (Vertical repairs); Compressive Str. - 5075 psi
	Similar to conc.											Tram Tech Gel	Patching; Overhead applicatio
				A	C	A	B	A				TramPlug	Instant set mortar for pluggi
				A	C	A	B	A				TramPatch - F	Fast set patching mortar (
				A	C	A	B	A				TramPatch - S	Slower set patching mortar (
	7.5 28 d			C	B	A	A	A		1.10 g Taber		TramFlor -Emerundum	Non-metallic, premium grade
	7.5 28 d			C	B	A	A	A		0.98 g Taber		TramFlor - Duramet	Non-rusting, high performance

NR - Not Recommended
S - Occasional Spillage
R - Resistant

A - Intact, Unaffected
B - Intact, Abrades Readily
C - Intact, Softened to Rubber Consistency

NAME	REMARKS
	Patching
	Patching; Crack Repair; Patching; Compressive Strength - 5225 psi
	Patching (Stopping water leaks)
out	Patching; Grouting etc Other formulations are available to suit specific applications ie: - Resist chemical attack (Sea water) - Low Heat of Hydration & Sulphate Resis. - Hot weather, High sulphate & salt water resistance - Rapid Str. Gain (4000 psi in 4 hr.), - Hydraulic cement; Rapid Str. gain.
CR)	Mixed and applied as a cementitious mortar.
	Mixed and applied as a cementitious coating.
	Additive based on condensed silica fume; Used to decrease the water permeability of concrete and increase its durability.
grade	Trowel - Good tamping; When concrete repair use Febweld as a primer. Grouting machinery; When restrained, does not shrink.
	Trowel - Good compaction; Please follow FEB guidelines carefully.
	Patching (Vertical repairs); Prime with slurry; Compressive Str. - 5075 psi at 28d ASTM C-109
	Patching; Overhead applications, Prime surface with slurry
	Instant set mortar for plugging water leaks.
F	Fast set patching mortar (2-3 min.)
S	Slower set patching mortar (10-20 min.)
erundum	Non-metallic, premium grade emery floor hardener.
Duramet	Non-rusting, high performance, metallic floor hardener.

J.

TABLE J
INORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Working Time min.	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi age std	Shear Strength psi age std	Bond Strength psi age std	Fl
Hey'Di K-11	Hey'Di American / Deutsche Hey'Di	USA / Germany	Cement	Slurry	39 +	75	180				X		2,650 C-39	332 28 d C-190		74-128 28 d E-149	
Hey'Di Special System	Hey'Di American / Deutsche Hey'Di	USA / Germany	Cement	Slurry + Powder	39 +	75	6				X			380 7 d C-190		42.2-84.6 3 d E-149	
Hey'Di Powder No.1	Hey'Di American / Deutsche Hey'Di	USA / Germany	Cement	Slurry	39 +	75	6				X			380 7 d C-190		42.2-84.6 3 d E-149	
Hey'Di Rapid	Hey'Di American / Deutsche Hey'Di	USA / Germany	Cement	Mortar	39 +	75	8				X	1,830 C-109	4,630 C-109				
Sikatop 111	Sika Canada Inc.	CAN	Polymer Reinf.Cem. Mortar	Liquid	-50 - 350	73	15		X	X		2,031 D-695	6,527 D-695				
Sikatop 121	Sika Canada Inc.	CAN	Polymer Reinf.Cem. Mortar	Thin Mortar	-50 - 350	73	15			X		1,886 D-695	7,978 D-695				
Sikatop 122	Sika Canada Inc.	CAN	Polymer Reinf.Cem. Mortar	Mortar	-50 - 350	73	15			X		3,481 D-695	7,542 D-695			2,466 Slant Cyl.	
Sikatop 123	Sika Canada Inc.	CAN	Polymer Reinf.Cem. Mortar	Gel Mortar	-50 - 350	73	15			X		2,321 D-695	7,252 D-695				
Sika Set Plug Premixed QuickSet	Sika Canada Inc.	CAN	Cement Mortar QuickSet	L-P	-50 - 350	73	1.5			X		4,206 W/C=.3 3,336 W/C=.5	6,817 W/C=.3 4,787 W/C=.5			3,046 Slant Cyl. 7 tons Load Pull Out	
Intraplast N Cementitious Grout Aid	Sika Canada Inc.	CAN	Additive														
Pronto 19	Sika Canada Inc.	CAN	Modified Metha-crylate	Liquid	35 - 80	73	15 - 20	0.5 L	X	X		12,035 D-695	13,050 D-695 (28 d)	2,030 7d D-638		2,610 7d Dry C-882 2,175 14d Moist C-882	

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

L-P - Liquid to Plastic

MECHANICAL PROPERTIES																						RESISTANCE												PR
Bond Strength				Flexural Strength			Modulus of Elasticity (Ec) - Compressive (Et) - Tensile			Coeff. of Thermal Expansion			Creep			Volume Change			Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion		Freeze/Thaw								
psi	age	std		psi	age	std	10E+5 psi	age	std	10E-6 /F	age	std	Result	age	std	Plastic or Hardened %	age	std							Result	std	cycles	std							
74-128	28 d	E-149		472	7 d	C-580																			170 SECS.		200	C-66						Hey'D
42.2-84.6	3 d	E-149																																Hey'D
42.2-84.6	3 d	E-149																																Hey'D
																																		Hey'D
				1,160	28 d		45.0												POOR	FAIR							120 - No deterioration								Sika
2,466	Slant Cyl.			1,450			34.8	28 d											POOR	FAIR							120 - No deterioration								Sikat
				2,321	28 d		43.5	28 d											POOR	FAIR							120 - No deterioration								Sikat
3,046	Slant Cyl.			1,741			45.0												POOR	FAIR							120 - No deterioration								Sikat
tons	Load Pull Out																		POOR	FAIR															Sika Fra
																																		Intra Cam Gro
3,610	7d	Dry C-882		4,350	1d	D-790	1.6 GPa	1d	D-695										GOOD	GOOD		F-P	GOOD												Pront
3,175	14d	Moist C-882																																

Volume Change Plastic or Hardened Age	Volume Change std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std	PRODUCT NAME	REMARKS
								170 SECS.		200	C-66	Hey'Di K-11	Positive waterproofing of concrete and masonry structures. Powder mixed with water and S-B bonding agent. Non-traffic bearing S-B bonding agent (Carboylated styrene butadiene co-polymer latex bonder) improves adhesion, abrasion.
												Hey'Di Special System	5 step method over actively leaking cracks in concrete and masonry surfaces. Surface must be free of paints, oils etc. and water flowing through crack.
												Hey'Di Powder No.1	Negative waterproofing of concrete and masonry surfaces. Powder mixed into slurry using water and S-B bonding agent.
												Hey'Di Rapid	Quick set cement grout for anchoring and repairs of damaged concrete and crack repair.
		POOR	FAIR							120 - No deterioration		Sikatop 111	Flowing repair mortar; Cementitious polymer reinforced.
		POOR	FAIR							120 - No deterioration		Sikatop 121	Thin patch repair mortar; Cementitious polymer reinforced.
		POOR	FAIR							120 - No deterioration		Sikatop 122	General purpose repair mortar, vert. or horiz. applications. Cementitious polymer reinforced.
		POOR	FAIR							120 - No deterioration		Sikatop 123	General purpose repair mortar, vert. or overhead applications. Cementitious polymer reinforced.
		POOR	FAIR									Sika Set Plug Premixed QuickSet	Quickset plugs, patches etc.; High strength achieved quickly.
												Intraplast N Cementitious Grout Aid	Expanding, fluidizing grout aid for prestressed cables etc. For pressure grouting with cement or cement & sand grouts used in the amount of 1% by weight of cement.
		GOOD	GOOD		F-P	GOOD						Pronto 19	Rapid curing, solvent free, crack sealer - non vapour barrier for horizontal concrete slabs, decks, ramps, etc.

K.

TABLE K
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors)		Generic Type	PLACEMENT				
				Consistency	Temp. Range Deg F	Working Time		
	NAME	Origin				Temp. Deg F	Time min	Sample Size
Epoxtite Grout 2388	AC Horn	USA	Epoxy	L-P	>50			
Epoxtite Grout 2391	AC Horn	USA	Epoxy	L-P	68-104			
Epoxtite Grout 2391	AC Horn	USA	Epoxy	L-P	40-68			
Concresive 1411	Adhesive Eng.	USA	Epoxy	Plastic	60-105	60 85 105	150 60 30	1 gal
Concresive 1001 LPL	Adhesive Eng.	USA	Epoxy	Liquid	50-105	50 77 105	180 70 25	1 gal
Concresive 1419	Adhesive Eng.	USA	Epoxy	Plastic	25-50	40 60 77	45 23 14	1 gal
Concresive 1440	Adhesive Eng.	USA	Epoxy	Plastic	80-105	80 105	45 35	1 gal
Concresive 1441	Adhesive Eng.	USA	Epoxy	Plastic	30-84	40 85	120 25	1 gal
Concresive 1442	Adhesive Eng.	USA	Epoxy	Plastic	25-50	25 50 77	50 30 20	1 gal
Concresive AEX 1470	Adhesive Eng.	USA	Epoxy	Plastic	50-95	50 95	60 14	1 qt
Concresive AEX 1482	Adhesive Eng.	USA	Epoxy	Plastic	50-95	77	20	1 qt
Concresive 1422	Adhesive Eng.	USA	Epoxy	Plastic	15-70	25 50 70	65 40 30	100 g
Concresive 1438	Adhesive Eng.	USA	Epoxy	Plastic	40-70	40 70 95	120 40 25	100 g
Concresive 1170	Adhesive Eng.	USA	Epoxy	Liquid	35-95	50 77	60 25	1 gal
Concresive AEX 1448L	Adhesive Eng.	USA	Epoxy	Plastic			40	200 g
Concresive AEX 1459	Adhesive Eng.	USA	Epoxy	Plastic	40-95	40 77	150 30	100 g
Concresive AEX 1512	Adhesive Eng.	USA	Epoxy	Plastic		77	60	225 g
Concresive AEX 1533	Adhesive Eng.	USA	Epoxy	L-P	60-115	77	35	1 qt
Concresive 1310	Adhesive Eng.	USA	Epoxy	L-P	>50	50 77	70 30	1 gal
Concresive 2020	Adhesive Eng.	USA	Acrylic Polymer conc.	L-P	25-100			
Concresive 2075	Adhesive Eng.	USA	Acrylic	Liquid	50-100	77	40	100 g
Concresive 1155	Adhesive Eng.	USA	Epoxy	L-P	>60	60 77	120 45	1 qt
Concresive AEX 1451	Adhesive ENG.	USA	Epoxy	L-P	30-90	40 77	150 30	100g
Concresive 1180	Adhesive Eng.	USA	Epoxy	L-P	>40	50 77	100 55	1 qt
Concresive AEX 1387	Adhesive Eng.	USA	Epoxy	L-P		75	20	Unfille
Concresive AEX 1448	Adhesive Eng.	USA		Plastic		75	45 60	sand 200g
Concresive 1315	Adhesive Eng.	USA	Epoxy	L-P	>50	50 77	120 47	1 qt

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) AASHTO T-237

CF - Co
DD - Da
FC - Fr
DC - Dr

ERIALS

ENT Time Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength (P.S.I.) 1 Day (std)	Compressive Strength (P.S.I.) 7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std	Flexural Strength psi	age	std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E +5 psi	age	std	Coeff. of Thermal Expansion 10E-6/F	age	std	Creep Result	age	std	Volume Ch Plastic o %
	X																										
	X																										
1 gal	X	X			8000 D-695	1500	7d	D-638	DD>5000	7d	(2)	>PCC						4.0(Ec)	7d	D-695						
1 gal	X	X			9300 D-695	4000	7d	D-638	DD>5000 CF	7d	(2)				570	7d	C-293	4.0(Ec)	7d	D-695						
1 gal			X						>5000 NF	2d	(2)																
1 gal	X	X			12000 D-695	4500	7d	D-638	>5000 CF	7d	(2)							5.5(Ec)	7d	D-695						
1 gal	X	X			17000 D-695	3200	7d	D-638	>5000 CF	7d	(2)	>PCC						6.5(Ec)	7d	D-695						
1 gal	X	X			15000 D-695	6000	7d	D-638	>5000 CF	7d	(2)	>PCC						5.0(Ec)	7d	D-695						
1 qt	X	X		Mortar 4000 C-579	Mortar 8000 C-579	2000-2500	28d	C-307				>PCC			2000-2500	28d	C-580	3.2								
1 qt	X			Mortar 4000 C-579	Mortar 10000 C-579	2000-2500	28d	C-307				>PCC			2000-2500	28d	C-580	0.15								
100 g	X	X			9000 D-695	4000	7d	D-638	>5000 CF	7d	(2)							2.0(Ec)	7d	D-695						
100 g		X			10000 D-695	3500	7d	D-638	>5000 CF	7d	(2)							4.0(Ec)	7d	D-695						
1 gal	X	X	X		7000 D-695	000	7d	D-638	DC 6000	14d	(2)	>PCC			DC>210	7d	C-293	1.1(Ec)	7d	D-695						
									WSC 5000	14d	(2)				WSC>160	7d	C-293									
									FC 4000	14d	(2)															
200 g			X		6800 D-695	2800	7d	D-638	WSC>4500	7d	(2)							1.0(Ec)	7d	D-695						
100 g	X	X				1700	7d	D-638	DC>7500 CF	7d	(2)							0.11(Ec)	7d	D-695						
225 g					See Remarks	6000	14d	D-638							8000	14d	D-790	2.4(Ec)	14d	D-695	40.0	14d	D-648			
1 qt	X	X			Mortar 8600 C-39	Mortar 2900	7d	C-307				>PCC			Mortar 5000	7d	C-580	8.25	7d	C-580	32.0					
					11800 C-759A	3000	28d	C-307							5200	28d	C-580									
1 gal	X	X			10000 D-695	6500	7d	D-638	DC>4000	7d	(2)							1.4(Ec)	7d	D-695						
	X				See Remarks	1200		C-307	>3200	7d	(2)	>PCC			2400		C-580				13.2					
100 g	X			With sand 12000 C-109		W/sand 2000						>PCC														
1 qt	X			Binder 4000 D-695		Binder 3200	7d	D-638										Binder 2.3(Et)	7d	D-638						
				Mortar 7500 D-695		Mortar 1400	7d	C-190							Mortar 2500	7d	C-293	Mortar 1.3(Ec)	7d	D-695	Mortar 14.0	7d	D-696			
100g	X	X			2900 D-695	2700	7d	D-638	DC>7000 CF	7d	(2)							0.35(Ec)	7d	D-695						
1 qt	X	X	X		9000 D-695	3800	7d	D-638	DC 2900		(2)				DC 200 CF		C-293	2.0(Ec)	7d	D-695						
					Mortar 11000 D-695				WSC 2500		(2)				WSC 160 CF		C-293	Mortar 2.55(Ec)								
Unfilled sand	X			3060 D-695	8000 D-695				4350	Id	(2)				FC 250 CF		C-293									
200g	X	X	X		6800	2800	7d		WSC 5800	7d								1.0(Ec)	7d							
1 qt	X				Unfilled Bind 2000 D-695	Unfilled Binder 2300	7d	D-638																		

CF - Concrete Failure
DD - Damp to Damp Conc.
FC - Fresh to Cure Conc.
DC - Dry Concrete

H.D.T. - Heat Deflection Temperature
NF - No Failure
WSC - Water Saturated Conc.
PCC - Portland Cement

P-F - Poor to Fair
F-E - Fair to Excellent
G-E - Good to Excellent
L-P - Liquid to Plastic Consistency

ty / d	Coeff. of Thermal Expansion 10E-6/F	age	std	Creep Result	age	std	Volume Change Plastic or Hardened %	age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
										F-E	EXCEL		G-E	EXCEL						Epontite Grout 2388	
										F-E	EXCEL		G-E	EXCEL						Epontite Grout 2391	
										F-E	EXCEL		G-E	EXCEL						Epontite Grout 2391	
95																				Concresive 1411	H.D.T. - 105 F
95																				Concresive 1001 LPL	Bonding New to Old Concrete H.D.T. - 127 F
																				Concresive 1419	
95																				Concresive 1440	Warm environments; H.D.T. - 142 F
95																				Concresive 1441	Moderate environments; H.D.T. - 146 F
95																				Concresive 1442	Cold environments; H.D.T. - 142 F
																				Concresive AEX 1470	Patching & Overlays (Exterior); H.D.T. - <75 F
																				Concresive AEX 1482	General Patching (Interior); Prime surface before application; H.D.T.
95																				Concresive 1422	Use below freezing, short term loads or of Intensity;
95																				Concresive 1438	Moderate temp. environments, areas with sh and with moderate intensity; H.D.T. - 118 F ASTM D-648
95										P-F	P-F	EXCEL		EXCEL						Concresive 1170	Coating steel against water corrosion, H.D.T. - 100 F
95																				Concresive AEX 1448L	Underwater adhesives; coating surfaces for corrosion protectio H.D.T - 110 F ASTM D-648 28d
95																				Concresive AEX 1459	H.D.T. - 70 F ASTM D-648
95	40.0	14d	D-648																	Concresive AEX 1512	Compressive Str. - 10000 psi D-695 14days H.D.T. - 118 F ASTM D-648
80	32.0																			Concresive AEX 1533	Grout; Protection & rehabilitation of conc Environments; Bonds to substrates in fres H.D.T. - 106 F
95										G-E	EXCEL	EXCEL	F-E	EXCEL				Very Poor		Concresive 1310	H.D.T - 119 F ASTM D-648
	13.2																			Concresive 2020	Application in sub-freezing temp.; Compressive Str. - 8200psi ASTM C-39 & H.D.T. - 115 F
										EXCEL	EXCEL	EXCEL		EXCEL						Concresive 1155	Use at room temp., H.D.T. - 131 F ASTM D-648Mod
98	Mortar 14.0	7d	D-696																		
95																				Concresive AEX 1451	Used as primer & mortar for patching, will H.D.T. - 75 F ASTM D-648
95										GOOD	GOOD		FAIR	GOOD						Concresive 1180	Bonding, Patching, Crack repair. H.D.T. - 125 F ASTM D-648Mod
																				Concresive AEX 1387	
																				Concresive AEX 1448	Underwater application. H.D.T. - 105 F 14d
																				Concresive 1315	Designed for stress relief in mortars and subjected to severe climatic cond.

AME	REMARKS
t 2388 t 2391 t 2391	
11	H.D.T. - 105 F
01 LPL	Bonding New to Old Concrete H.D.T. - 127 F
19	
40	Warm environments; H.D.T. - 142 F
41	Moderate environments; H.D.T. - 146 F
42	Cold environments; H.D.T. - 142 F
X 1470	Patching & Overlays (Exterior); H.D.T. - <75 F
X 1482	General Patching (Interior); Prime surface before application; H.D.T. - 105 F
22	Use below freezing, short term loads or of moderate Intensity;
38	Moderate temp. environments, areas with short term loads and with moderate intensity, H.D.T. - 118 F ASTM D-648
70	Coating steel against water corrosion, H.D.T. - 100 F
X 1448L	Underwater adhesives; coating surfaces for corrosion protection. H.D.T - 110 F ASTM D-648 28d
X 1459	H.D.T. - 70 F ASTM D-648
X 1512	Compressive Str. - 10000 psi D-695 14days H.D.T. - 118 F ASTM D-648
X 1533	Grout; Protection & rehabilitation of conc. & steel in Marine Environments; Bonds to substrates in fresh & sea water H.D.T. - 106 F
10	H.D.T - 119 F ASTM D-648
20	Application in sub-freezing temp.; Compressive Str. - 8200psi ASTM C-39 & 9500psi ASTM C-579 H.D.T. - 115 F
55	Use at room temp., H.D.T. - 131 F ASTM D-648Mod
X 1451	Used as primer & mortar for patching, will cure under water H.D.T. - 75 F ASTM D-648
30	Bonding, Patching, Crack repair. H.D.T. - 125 F ASTM D-648Mod
X 1387	
X 1448	Underwater application. H.D.T. - 105 F 14d
15	Designed for stress relief in mortars and patches for PCC subjected to severe climatic cond.

L.

TABLE L
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES Compressive Strength (P.S.I.) 1 Day (std)	7 Day (std)	Tensile Strength psi age std	Shear Strength psi age std	Bond Strength psi age std	Flex psi
Bonsal conc. Bonding	Bnsal	USA	Polymer Emulsion conc.	L-P	45-95		<20			X			Filled Binder 8000	Filled Binder 1250 7d C-190			
Burk Acrylic Patch	Burk	USA	Acrylic	Plastic	>32		10		X			Air cured 3340 Water cured 2800	Air cured 5050 Water cured 6525			>250	
#9 Conc. Bonder	Cappar	CAN	Epoxy	Liquid	>32		60-600			X		12000	16500	6000	680		90
#16 Clear conc Patch	Cappar	CAN	Epoxy	Plastic	>0		18			X		15000	23000	6970		7380	125
#19 Conc. Bonder	Cappar	CAN	Epoxy	Liquid	>32		60-600			X		12500	17000	6000	680		92
CS-66 Poly Patch	Cappar	CAN	Polyester	Plastic	>0		30		X			10000	12000	2000			56
#4 Epoxy Cement	Cappar	CAN	Epoxy	Liquid	>0		30			X		17000	21000	6400		7000	95
CS-65 Epoxy Mortar	Cappar	CAN	Epoxy	Liquid	>32		60			X		16000	23000				120
415 Epoxy Mortar Mix	Cappar	CAN	Epoxy	Liquid	>32		60				X	15000	23000	7500			115
CS-77 Epoxy Mortar	Cappar	CAN	Epoxy	Liquid	>32		60		X			18000	25000	7200			102
104 Mortar Mix	Cappar	CAN	Epoxy	Liquid	>32	70	24				X	15000	22000				110
10-21 Prime Coat	Celtite	USA	Acrylic Emulsion	Liquid													
10-25 Celbond	Celtite	USA	Latex Emulsion	Liquid													
21-05 Universal	Celtite	USA	Polyester	L-P	32-90		6-180		X	X			15000 C-109	2000 7d C-307			
21-12 Uniflex	Celtite	USA	Polyester	L-P	32-90		6-120		X	X		6000 C-109	7700 C-109	1560 D-638		350 CF	
21-24 TX Grout	Celtite	USA	Polyester	Plastic	32-90		6-120		X	X			14000 C-109	2000 7d C-307			
42-06 Hi-Flow	Celtite	USA	Epoxy	Liquid	45-84		18-78		X			10000 C-109	14000 C-109	2000 7d C-307		532 7d	
42-36 Hi-Impact TX	Celtite	USA	Epoxy	Plastic	40-80		42		X			7000 C-109	7900 C-109	2500 7d C-307			55
42-45 Hi-Bond	Celtite	USA	Epoxy	Liquid	50-90		30-66		X	X	X	5000 D-695	6500 D-695	4500 7d D-638		2480 2d C-881	
42-48 Hi-Bond TX	Celtite	USA	Epoxy	Plastic	50-90		30-75		X	X			6000 D-695	3000 D-638		2000 2d C-882	
42-49 Hi-Pour	Celtite	USA	Epoxy	Liquid	50-90		18-60		X	X	X	5000 C-109	10700 C-109	2830 7d C-307			
42-66 Hi-Dro Flex	Celtite	USA	Epoxy	Liquid	50-90		30-180		X	X	X	1700 C-109	2500 C-109	517 7d			
42-76 Hi-Fill	Celtite	USA	Epoxy	Liquid	50-90		600-2160		X				15000 C-109	C-309	1800	>Concrete	50
21-62 Anchor Grout LT	Celtite	USA	Polyester Resin	Liquid	(-40)-0		6		X	X		5700	9000	1200			
Modifier A	Dow Chemical	CAN	SBR Latex	Plastic	50-86		30		X	X	X		3915 C-39		2510 28d		9
348 Adhesive	Ceilcote	CAN	Epoxy	Liquid	>50	50 60 70 80 90	360 180 60 30 20		X				4200	DC to DC 360 FC to DC 505			FC t 36 FC t 40
Deltapox VM	DE NEEF America	USA	Epoxy	Plastic			1440		X				See Remarks	800			
Aquaflex and Aquaflex LV	Dural	CAN	Epoxy	L-P		75	60		X	X	X		Binder 6000 Mortar 9000	1300 7d			

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

CF - Concrete Failure
DC - Dry Concrete
FC - Fresh to Hardened Conc.

H.D.T. - Heat Deflection Temperature
N/R - Not Recommended
L-P - Liquid to Plastic Consistency

MECHANICAL PROPERTIES																						RESISTANCE										
ear Strength			Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) - Compressive (Et) - Tensile			Coeff. of Thermal Expansion			Creep			Volume Change				Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion		
i	age	std	psi	age	std	psi	age	std	10E +5 psi	age	std	10E-6/F	age	std	Result	age	std	Plastic or Hardened %	age	std								Result	std	
			>250																													
0			7380			9000			5.5			33.0						0.2				GOOD	GOOD	GOOD	GOOD	EXCEL						
0						12500			4.5			36.0						0.3				GOOD	GOOD	GOOD	GOOD	EXCEL						
			7000			9200			5.0			35.0						0.25				GOOD	GOOD	GOOD	GOOD	EXCEL						
						5000			2.0			20.0										N/R	N/R	N/R	N/R	EXCEL						
						9500			4.25			36.0						0.3				GOOD	GOOD	GOOD	GOOD	EXCEL						
						12000			4.25			36.0										GOOD	GOOD	GOOD	GOOD	EXCEL						
						11500			4.3			36.0										GOOD	GOOD	GOOD	GOOD	EXCEL						
						10200			4.88			36.0										GOOD	GOOD	GOOD	GOOD	EXCEL						
						11000			4.30			36.0										GOOD	GOOD	GOOD	GOOD	EXCEL						
																						N/R	GOOD	GOOD	GOOD	GOOD						
			350 CF																													
			532	7d		5500	7d	D-790	24.4(Et)			14.2		D-696								GOOD	GOOD	GOOD		GOOD			GOOD			
			2480	2d	C-881				2.1(Ec)	7d	C-109	64.0		C-531								GOOD	GOOD	GOOD		GOOD			GOOD			
			2000	2d	C-882				2.5(Ec)	28d	D-695	26.6	7d	D-696				.025	7d	D-2566		GOOD	GOOD	GOOD		GOOD			GOOD			
									5.15(Ec)	7d	C-307	17.1										GOOD	GOOD	GOOD		GOOD			GOOD			
0			>Concrete			5000		D-790	38.2			21.7			Low			-0.03				GOOD	GOOD	GOOD		GOOD			GOOD			
																						FAIR	FAIR	FAIR		GOOD			FAIR			
0	28d					970	28d	C-78				430-560			See Remarks			Hardened 0.074	28d							EXCEL						
						FC to Steel 380 FC to DC 405																												
																						GOOD	GOOD	EXCEL		EXCEL						

L2

L3

Change or Hardened age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
												Bonsal conc. Bonding	Adhesive and patching material. Used as an overlay under 2" thick. H.D.T. - 54 F ASTM D-648Mod
												Burk Acrylic Patch	Underwater repairs.
		GOOD	GOOD	GOOD	GOOD	EXCEL						#9 Conc. Bonder	Application thickness 12 mils.
		GOOD	GOOD	GOOD	GOOD	EXCEL						#16 Clear conc Patch	
		GOOD	GOOD	GOOD	GOOD	EXCEL						#19 Conc. Bonder	
		N/R	N/R	N/R	N/R	EXCEL						CS-66 Poly Patch	
		GOOD	GOOD	GOOD	GOOD	EXCEL						#4 Epoxy Cement	
		GOOD	GOOD	GOOD	GOOD	EXCEL						CS-65 Epoxy Mortar	Overlay
		GOOD	GOOD	GOOD	GOOD	EXCEL						415 Epoxy Mortar Mix	Overlay
		GOOD	GOOD	GOOD	GOOD	EXCEL						CS-77 Epoxy Mortar	Overlay
		GOOD	GOOD	GOOD	GOOD	EXCEL						104 Mortar Mix	Overlay
		N/R	GOOD	GOOD	GOOD	GOOD						10-21 Prime Coat	
												10-25 Celbond	
		GOOD	GOOD	GOOD		GOOD		GOOD				21-05 Universal	
		GOOD	GOOD	GOOD		GOOD		GOOD				21-12 Uniflex	Flexible polyester grout, patching; crack filling, comes in Summer and Winter grade.
		GOOD	GOOD	GOOD		GOOD		GOOD				21-24 TX Grout	Vert & overhead applications.
7d	D-2566	GOOD	GOOD	GOOD		GOOD		GOOD				42-06 Hi-Flow	
		GOOD	GOOD	GOOD		GOOD		GOOD				42-36 Hi-Impact TX	Patching
		GOOD	GOOD	GOOD		GOOD		GOOD				42-45 Hi-Bond	Bonding, crack repair,
		GOOD	GOOD	GOOD		GOOD		GOOD				42-48 Hi-Bond TX	Patching, bonding, and grouting
		GOOD	GOOD	GOOD		GOOD		GOOD				42-49 Hi-Pour	Grouting
		GOOD	GOOD	GOOD		GOOD		GOOD				42-66 Hi-Dro Flex	Patching, crack repair. Used for underwater application
		GOOD	GOOD	GOOD		GOOD		GOOD				42-76 Hi-Fill	Grouting
		FAIR	GOOD	FAIR		GOOD		FAIR				21-62 Anchor Grout LT	Grouting in sub-zero temps.
d	28d					EXCEL				See Remarks		Modifier A	Patching; Creep - 1 year data, 3.7E -7 in/in/psi at 1700 psi, 4.1E -7 in/in/psi at 1700 psi control. Freeze/Thaw - 87% of original dynamic modulus, 620 psi
												348 Adhesive	Bonding, patching. Two grindes available, standard and fast set, vert. & horiz. applications;
										No influence		Deltapox VM	Patching, (vert. & overhead appl.); Compressive Str. - 8700 psi
		GOOD	GOOD	EXCEL		EXCEL						Aquaflex	Aquaflex system is available in three consistancies: Used as a protective coating above and underwater.

L3

L4

M.

TABLE M
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dr (1
Aquaflex Gel	Dural	CAN	Epoxy	Plastic		75	60		X
Aquaseal Gel	Dural	CAN	Epoxy	Plastic		75	60		X
Duralbond	Dural	CAN	Epoxy	Liquid	>50	75	40	1 gal	X
Duralcrete Gel	Dural	CAN	Epoxy	Plastic	>50	75	45-65		X
Duralith Gel	Dural	CAN	Epoxy	Plastic	>30	75	10-20		X
Duraltex	Dural	CAN	Epoxy	L-P	>40	75	30-50		
Flexocrete	Dural	CAN	Epoxy	L-P	>50	75	30-40		X
Flexolith	Dural	CAN	Epoxy	L-P	>30	75	15-30		X
Poly Plug	Dural	CAN	Polymer-base	Plastic			5		X
Dural 104	Dural	CAN	Epoxy Polysulfide	Liquid	>50	75	45	1 gal	X
Duracryl	Dural	CAN	Methylmethacrylate Polymer Conc	Plastic		75	180		X
Duralpatch	Dural	CAN	Epoxy	Liquid	>30	60 75 90	20 15 10		X
Duraltreat	Dural Int'l Corp.	USA	Siloxane	Liquid	>32				X

Note: Unless otherwise indicated, all standards refer to "ASTM". L-P - Liquid
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

Dry (1)	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES: Compressive Strength (F.S.1.) 1 Day (std)	Compressive Strength (F.S.1.) 7 Day (std)	Tensile Strength psi	Tensile Strength age	Tensile Strength std	Shear Strength psi	Shear Strength age	Shear Strength std	Bond Strength psi	Bond Strength age	Bond Strength std	Flexural Strength psi	Flexural Strength age	Flexural Strength std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E +5 psi	Modulus of Elasticity age	Modulus of Elasticity std	Coeff. of Thermal Expansion 10E-6/F	Coeff. of Thermal Expansion age	Coeff. of Thermal Expansion std	Creep Result	Creep age	Creep std	Volume Change Plastic or Hard %	Volume Change age
X		X	X	X		Mortar 9000 C-109	1300	7d																					
X		X	X	X		Morta.. 8000 C-109	4000	7d																					
X	el	X					4000																						
X		X	X			See Remarks	Binder >4500						550						Binder 2.25-3.0(Et) 2.0-3.0(Ec) Mortar 2.5-3.5(Ec)										
X			X			See Remarks	Binder >5000												Binder 2.25-5.0(Et) 2.0-5.0(Ec) Mortar 2.25-6.0(Ec)										
				X		See Remarks	>3000		D-638																				
X		X	X			See Remarks	Binder >2500												Binder 0.8-1.2(Ec) 0.85-1.2(Et)		D-790								
																			Binder 0.9-1.3(Et) 0.9-1.3(Ec) Mortar 1.1-1.5(Ec)										
X		X	X			See Remarks	Binder 2500-3500												Binder 0.9-1.3(Et) 0.9-1.3(Ec) Mortar										
X		X		X		See Remarks	3000												1.0-1.4(Ec)										
X	el	X					4500-5000						550-600						2.5-3.0										
X		X	X			12500	1850									3300						11.6							
X		X			Mortar 8000		Mortar >1300	1d																					
X		X																											

Liquid to Plastic Consistency

of Elasticity ompressive ensile si age std	Coeff. of Thermal Expansion 10E-6/F age std	Creep Result age std	Volume Change Plastic or Hardened % age std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std	PRODUCT NAME	REM
				GOOD	GOOD	EXCEL		EXCEL				Aquaflex Gel	Non sag patching, mat'l for use water appl. and seal insop cr
				GOOD	GOOD	EXCEL		EXCEL				Aquaseal Gel	Aquaseal is available in three applications: Aquaseal (coat LV (mortar binder and pressur sag patching vert. surfaces), All three consistencies can be
D(Et) (Ec)												Duralbond Duralcrete Gel	Available in three consistencie Duralcrete -(adhesive and mor Duralcrete LV -(pressure inje Duralcrete Gel -(Non-sag adhe vert. and ov
(Ec)													The system is used for Bondin transferal is reqd. Compressive Str. - Binder >80
D(Et) (Ec)												Duralith Gel	Duralith system is available in Duralith (adhesive and mortar pressure injection, bonding, e adhesive and biner for vert. etc).
D(Ec)													Compressive Str. - Binder >90
(Ec) (Et)	D-790											Duraltex	Patching, resurfacing marine fl Compressive Str.>4000psi ASTM
(Et) (Ec)												Flexocrete	Flexocrete system available as: patching, horiz. repair), Flex patching of vert. and overhea used for Bonding, Patching, Cr relieving properties are reqd. thermal movements;
(Ec)													Compressive Str. - Binder >500
(Et) (Ec)												Flexolith	Flexolith system has similar use Flexocrete system, however it applications (30F).
(Ec)													Flexolith system is available Gel. Compressive Str. - Binder >500
												Poly Plug	Patching (stops water leaks). Compressive Str. - 7000 psi
	11.6											Dural 104	Bonding.
												Duracryl	Patching.
												Duralpatch	Duralpatch system is available binder & overlay); Duralpatch ntions. etc); Duralpatch Gal
												Duraltreat	On concrete, masonry, bricks etc water & salts; Used on ant. w

ODUCT NAME	REMARKS
ew Gel	Non sag patching, mat'l for use on vert. surfaces, under-water appl. and seal insop cracks before injection.
al Gel	Aquaseal is available in three consistencies for different applications: Aquaseal (coating splash zone area) Aquaseal LV (mortar binder and pressure grouting), Aquaseal Gel (non-sag patching vert. surfaces), All three consistencies can be used for underwater applications
ond rete Gel	Available in three consistencies: Duralcrete -(adhesive and mortar binder for horiz. repairs); Duralcrete LV -(pressure injection into very fine cracks); Duralcrete Gel -(Non-sag adhesive mortar and binder for vert. and overhead repairs); The system is used for Bonding, Patching or when load transferal is reqd. Compressive Str. - Binder >8000 psi, Mortar > 9000 psi
th Gel	Duralith system is available in two consistencies: Duralith (adhesive and mortar binder for horiz. repairs, pressure injection, bonding etc) Duralith Gel (non-sag adhesive and biner for vert. & overhead repairs, patching etc). Compressive Str. - Binder >9000 psi, Mortar >9000 psi
ew	Patching, resurfacing marine floor decks. Compressive Str.>4000psi ASTM D-695
rete	Flexocrete system available as: Flexocrete (overlays, patching, horiz. repair), Flexocrete Gel (non-sag, epoxy patching of vert. and overhead surfaces); This system is used for Bonding, Patching, Crack Repair when stress-relieving properties are reqd. to withstand mechanical and thermal movements; Compressive Str. - Binder >5000 psi, Mortar 7000 psi
ith	Flexolith system has similar uses and properties as Flexocrete system, however it is suited for low temp. applications (30F). Flexolith system is available as: Flexolith and Flexolith Gel. Compressive Str. - Binder >5000 psi, Mortar >7000 psi
lug	Patching (stops water leaks). Compressive Str. - 7000 psi
104	Bonding.
yl	Patching.
atch	Duralpatch system is available as: Duralpatch (mortar, binder & overlay); Duralpatch LV (crack repair, pressure ntions. etc); Duralpatch Gel (Vert. & Overhead repairs)
treat	On concrete, masonry, bricks etc.; To block penetration of water & salts; Used on ext. walls, parking decks & bridges.

N.

TABLE N
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std	Flexural psi
Dural 211	Dural	CAN	Epoxy Polysulfide	L-P	>50	75	40	1 gal	X				See Remarks	Mortar 800									
SBR Latex	The Euclid Co.	USA	Carboxylated Butadiene Styrene	Liquid	50-80				X	X			Mortar 4042	C-109	Mortar 480	7d	C-190						20
Euco Weld	The Euclid Co.	USA	Polyvinyl acetate base	Liquid	>50				X	X								700					
Euco #452 Gel	The Euclid Co.	USA	Epoxy	Plastic		60 70 90	75 60 45	1 pint 1 pint 1 pint	X				Mortar 10000					7846			623	1d		
Epoxy Adhesive #620	The Euclid Co.	USA	Epoxy	L-P	>35	35 72 90	300 40 25		X	X		10500	C-109	15000	C-109	4000	7d	D-638				3200	1d	C-882	80
FX-756 Hydro Ester	Fox Industries	USA	Epoxy	Plastic	>40	72	25		X		X			With filler		>3500	7d	D-638Mod						
FX-742 Hydro Ester	Fox Industries	USA	Epoxy	L-P	32-75	32	30		X	X	X	Neat		Neat 9000								5500	7d		
FX-752 All Purpose Epoxy	Fox Industries	USA	Epoxy	L-P	>40	75 60 75	15 40 30		X	X	X	12000	D-695	6500	1d	D-638									
FX-762 Hydro Ester	Fox Industries	USA	Epoxy	L-P	>55	90 60 75	25 40 35		X	X	X	With filler 7000 6000	D-695	11000	D-695	3500	14d	D-638	3000		(2)			
FX-772 Hydro Ester	Fox Industries	USA	Epoxy	Liquid	>40	90 60 75	30 40 35		X	X	X	With filler 6000				4500	7d	D-638						
FX-792LP Hydro Ester	Fox Industries	USA	Epoxy	Liquid	>55	90 70	30 60		X	X	X	With filler 6000	D-695			3500	14d	D-638						
FX-743 Hydro Ester	Fox Industries	USA	Epoxy	Plastic	>32	30 45 70	20 17 6	100 g	X	X		10400	(2)	7000 12000	(3)	4000	7d					Neat 5000	1d	C-881	
FX-732 All Purpose Epoxy	Fox Industries	USA	Epoxy	L-P	>30	30 60 75	60 20 25		X					See Remarks		>6000			2000						
FX-761 LV	Fox Industries	USA	Epoxy	L-P	>60	72	35		X	X	X			Neat 12000 Mortar 9500		6000	7d	D-638						
FX-771LV Hydro Ester	Fox Industries	USA	Epoxy	Liquid	>40	75	40		X	X				See Remarks		1800	1d	C-190						
FX-791 LV LP	Fox Industries	USA	Epoxy	L-P	>40	75	60		X	X	X					6000	7d	D-638						
FX-733	Fox Industries	USA	Epoxy	Plastic	>30	70	30		X					14000	D-695	5000		D-638						
FX-753 HM	Fox Industries	USA	Epoxy	Plastic	>40				X		X			See Remarks		>3500		D-638				4000	7d		
FX-763	Fox Industries	USA	Epoxy	Plastic	>40				X		X			See Remarks		>2500		D-638				>3000	7d	C-882	
FX-793 LP	Fox Industries	USA	Epoxy	Plastic	>55	70	60		X	X	X			7100		1200	7d	C-190						
FX-775 LM	Fox Industries	USA	Epoxy	Liquid	>40				X	X	X			Neat >10000 (Mod) >15000 D-695 Mortar >7000 (Mod)		3000 Neat >6000	7d	D-638 D-638						
FX-70-6	Fox Industries	USA	Epoxy	Liquid	>40	70	60		X		X			With filler 9500 (Mod) >7500		With filler 1900	7d	C-190						
FX-70-8	Fox Industries	USA	Epoxy	Liquid	>32	70	120		X		X	5000												

Note: Unless otherwise indicated, all standards refer to "ASTM"
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) ASTM C-109 at 30 deg. F
(3) AASHTO M-235

L-P - Liquid to Plastic Consistency

th / td	MECHANICAL PROPERTIES: Shear Strength psi	age	std	Bond Strength psi	age	std	Flexural Strength psi	age	std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+5 psi	age	std	Coeff. of Thermal Expansion 10E-6 /F	age	std	Creep Result	age	std	Volume Change Plastic or Hardened %	age	std	RESISTANCE: Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	C
190							2082	7d	C-256																				
	700																												
	7846			623	1d																								
638				3200	1d	C-882	8000	7d	C-348																				
38Mod				5500	7d																	EXCEL			EXCEL				
638																													
638	3000		(2)																										
638																													
638																													
				Neat 5000	1d	C-881																EXCEL			EXCEL				
	2000																												
638																													
190										Mortar 22.0																			
638																													
638				4000	7d																	EXCEL			EXCEL				
638				>3000	7d	C-882																EXCEL			EXCEL				
190																						EXCEL			EXCEL				
638																													
638																													
190																													

N2 N3

Change or Hardened age	Change or Hardened std	RESISTANCE: Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std	PRODUCT NAME	REMARKS
												Dural 211	Bonding; Patching; Crack Repair. Compressive Str. w/o sand >400psi, with sand 8000psi
												SBR Latex	Bonding; Patching; This product is an admixture for conc. and mortars. Prime damp surface with slurry if used as an overlay.
												Euco Weld	Bonding; Performance range (-35F) to 275F; Bonding Str. 150 psi in 1 hr.
												Euco #452 Gel	Euco #452 Epoxy System is available as: #452 LV (grout dry and slightly damp cracks, primer); #452 (overlays, grouting etc), #452 Gel (bonding, as a mortar it can be used for vert. and overhead repairs, patching)
												Epoxy Adhesive #620	Epoxy Adhesive #620 is available as #620 M (mortar); 620 LV (low viscosity); #620 Gel; Patching; Crack Repair.
				EXCEL		EXCEL						FX-756 Hydro Ester	Bonding; Patching
												FX-742 Hydro Ester	Bonding; Patching, >75F use FX-752, between 32F to 75F use FX-742.
												FX-752 All Purpose Epoxy	Bonding; Patching.
												FX-762 Hydro Ester	Bonding; Patching.
												FX-772 Hydro Ester	Bonding; Patching.
				EXCEL		EXCEL						FX-792LP Hydro Ester	Bonding; Patching; Material has extended pot life
												FX-743 Hydro Ester	Bonding; non-sag material, bonding vert. & overhead surfaces at low temp.
												FX-732 All Purpose Epoxy	Patching; product will cure at 30F, Rapid strength gain 4000 psi in 4 hr at 75F; Compressive strength > 14,000 psi
												FX-761 LV	Patching; Marine structure application.
												FX-771LV Hydro Ester	Patching; Grouting base plates; Crack Repair; Comp.Str.14000psi Do not use to bond new to plastic conc (use FX-772).
												FX-791 LV LP	Patching; Crack Repair; Material has a long pot life, do not use to bond new to plastic conc.
				EXCEL		EXCEL						FX-733	Patching, (vert. & overhead surfaces).
				EXCEL		EXCEL						FX-753 HM	Patching, (vert. & overhead surfaces); Compressive Str. - 14,000 psi ASTM C-109.
				EXCEL		EXCEL						FX-763	Patching, (vert. & overhead surfaces), marine structure application; Compressive Str. - 10,500 psi ASTM C-109Mod.
				EXCEL		EXCEL						FX-793 LP	Patching, (vert. & overhead surfaces).
												FX-775 LM	Patching
												FX-70-6	FX-70 system materials designed for marine applications.
												FX-70-8	

TABLE 0
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors)		Generic Type	PLACEMENT					Dr (1
	NAME	Origin		Consis-tency	Temp. Range Deg F	Working Time Temp. Deg F	Working Time Time min	Working Time Sample Size	
FX-765	Fox Industries	USA	Epoxy	Plastic	50-75				
Nitomortar HB	Fosroc	CAN	Epoxy	Plastic	41-90	68 95	45 20		X
Nitomortar S	Fosroc	CAN	Epoxy	Plastic	41-90	68 95	45 20		X
Nitomortar Polyester	Fosroc	CAN	Polyester	L-P	32-95	41 77 95	160 15 5		X
Deco Raz 3516 (Unfilled)	General Polymers (Superior Coatings)	CAN	Epoxy	Liquid			77		
Deco Raz TPM 711	General Polymers (Superior Coatings)	CAN	Polymer	Plastic	>45		180-240		
Deco Raz SRC 3575 Gel	General Polymers (Superior Coatings)	CAN	Epoxy	Plastic		75	50		X
Deco Raz SCR 3577 Gel	General Polymers (Superior Coatings)	CAN	Epoxy	Plastic		75	20-30		X
Weld Crete	Larsen Products	CAN	Polyvinyl Acetate Homopoly-mer	Liquid			60		X
Acrylic Admix 101	Larsen Products	CAN	Acrylic	Liquid	>50				X
Everbond	L&M Construction	USA	Acrylic	Liquid	>50		30		X
Epopatch	L&M Construction	USA	Epoxy	Plastic	50-150	77	60		X
Sealtight Bondlok	W.R Meadows	CAN	Epoxy	L-P	>40	70 100	30 15		X

Note: Unless otherwise indicated, all standards refer to "ASTM"
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) CRD C-52-54

CF - Concre
N/R - Not R
WSC - Water

RIALS

Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength (PSI) 1 Day (std)	Compressive Strength (PSI) 7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std	Flexural Strength psi	age	std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+5 psi	age	std	Coeff. of Thermal Expansion 10E-6 /F	age	std	Creep Result	age	std	Volume Ch Plastic or %
			X	Neat 8000(D-695)																							
	X				See Remarks	1087		C-307	2320		BSS-2782	2900			2175		C-580	6.5			11.1			See Remarks			Hardened -0.10
	X				See Remarks	1450		C-307	4060		BSS-2782	4785			2900		C-580	23.5			12.8			See Remarks			Plastic 0.0
	X	X				1740		C-307	3770		BSS-2782				2900		C-580	1.0-2.0			13.9						Hardened -0.1 Plastic 0.0 Hardened
		X			See Remarks	9000		D-638	900	7d		800	1d		13000-14000		D-790										
		X			5300							WSC >300	28d		1700	28d					Comparable to conc.						
	X				See Remarks	Neat >4600		D-638										Neat 2.0-3.0(Ec) Mortar 3.0(E_)		D-695 C-579								
	X				See Remarks	Neat >3000	14d	D-638										Neat 2.0(Ec) Mortar 3.0(Ec)		D-695 C-579								
	X	X				385 CF	28d	C-190				470		C-39	603		C-78										
	X				4125	492	7d					450	7d		1192	7d											
	X					600		C-190	825		C-109				725		C-78										
	X	X			See Remarks	5000		D-638				1250		D-1002	3200		C-293							7.2E-5 /psi		C-512	
	X					400-450 CF			4250																		

- Concrete Failure
- Not Recommended
- Water Saturated Concrete

G-E - Good to Excellent
L-P - Liquid Consistency
N/A - Not Applicable

Elasticity Passive age	Elasticity Passive std	Coeff. of Thermal Expansion 10E-6 /F age	Coeff. of Thermal Expansion std	Creep Result	Creep age	Creep std	Volume Change Plastic or Hardened %	Volume Change age	Volume Change std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std	PRODUCT NAME	REMARKS
																				FX-765	Pre-mixed Grout; Marine structure applic
		11.1		See Remarks			Hardened -0.10			G-E	EXCEL	EXCEL	G-E		N/A			50 No wt loss	C-67	Nitomortar HB	Patching (Overhead, Vertical surfaces); Creep 2-5 times that of conc. Compressive Str. - 5800 psi ASTM C-579
		12.8		See Remarks			Plastic 0.0 Hardened -0.1			G-E	EXCEL	EXCEL	G-E		N/A			50 No wt loss	C-67	Nitomortar S	Patching; Crack Repair; Creep 2-5 times that of conc. Compressive Str. - 10,150 psi ASTM C-5
		13.9					Plastic 0.8 Hardened 0.0			FAIR	FAIR	FAIR	FAIR	FAIR	N/A			50 No wt loss	C-67	Nitomortar Polyester	Patching; Creep 2-5 times that of conc. Compressive Str. - 8700 to 9430 psi at
		Comparable to conc.																		Deco Rez 3516 (Unfilled)	Patching; Crack Repair; Compressive Str. - 15,000psi ASTM D-6
																				Deco Rez TPM 711	Deco Rez TPM 711, 721, 722, 723 all had perties however each was designed for ia.; Horizontal, Vertical or Overhead TPM 722 - Compressive Str. 5800 psi TPM 723 - Compressive Str. 4500 psi an
	D-695 C-579																			Deco Rez SRC 3575 Gel	This system is available in three consist Deco-Rez SRC 3575 LV, SRC 3575 and SRC SRC 3575 LV - Patching and adhesive for SRC 3575 - Patching, Bonding, Pressu SRC 3575 Gel-Paste for vert. or overhea Compressive Str. - Neat 10,000psi, Mort
	D-695 C-579																			Deco Rez SCR 3577 Gel	This system is available in three consist Deco-Rez SRC 3577 LV, SRC 3577, SRC 357 is designed for low modulus of elastici relief properties with variations in te SRC 3577 LV - Patching, pressure inject SRC 3577 - Binder for use with skid SRC 3577 Gel - Paste for vert. or overh Compressive Str. - Neat >6500psi, Morta
										GOOD										Weld Crete	Bonding.
																				Acrylic Admix 101	Bonding
				7.2E-5 /psi	C-512											0.29	(2)	100	C-172	Everbond	Patching; Bonding, Crack Repair, when use in concrete
																				Epopatch	Patching, Crack Repair, Creep based on 20 Compressive Str. - 1200 psi ASTM D-695
																				Sealtight Bondlok	Bonding; Patching; Crack Repair

UCT NAME	REMARKS
	Pre-mixed Grout; Marine structure applications.
r HB	Patching (Overhead, Vertical surfaces); Creep 2-5 times that of conc. Compressive Str. - 5800 psi ASTM C-579
r S	Patching; Crack Repair; Creep 2-5 times that of conc. Compressive Str. - 10,150 psi ASTM C-579
r Polyester	Patching; Creep 2-5 times that of conc. Compressive Str. - 8700 to 9430 psi at 28 days.
3516 d)	Patching; Crack Repair; Compressive Str. - 15,000psi ASTM D-695
TPM 711	Deco Rez TPM 711, 721, 722, 723 all had similar mechanical properties however each was designed for a specific applcation ie.: Horizontal, Vertical or Overhead TPM 722 - Compressive Str. 5800 psi TPM 723 - Compressive Str. 4500 psi and Flexural Str.1200 psi
SRC 3575	This system is available in three consistencies: Deco-Rez SRC 3575 LV, SRC 3575 and SRC 3575 Gel; SRC 3575 LV - Patching and adhesive for pressure injection. SRC 3575 - Patching, Bonding, Pressure injecting SRC 3575 Gel-Paste for vert. or overhead repairs. Compressive Str. - Neat 10,000psi, Mortar 12,000psi ASTM D-69
SCR 3577	This system is available in three consistencies: Deco-Rez SRC 3577 LV, SRC 3577, SRC 3577 Gel. This system is designed for low modulus of elasticity and stress relief properties with variations in temp: SRC 3577 LV - Patching, pressure injection applications. SRC 3577 - Binder for use with skid resistant overlays etc SRC 3577 Gel - Paste for vert. or overhead applications. Compressive Str. - Neat >6500psi, Mortar >8000psi ASTM D-695
e	Bonding.
dmix 101	Bonding
	Patching; Bonding, Crack Repair, when used as an admixture in concrete Patching, Crack Repair. Creep based on 200psi load in/in Compressive Str. - 1200 psi ASTM D-695
Bondlok	Bonding; Patching; Crack Repair

P.

TABLE P
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	Compressive Strength ASTM C-109 PSI 1 Day (std)	7 Day (std)	MECHANICAL P Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std
Epoxy Binder #38	Non-Crete Chem. (Crown Zellerbach)	CAN	Epoxy	Plastic	>50	77	55		X													
Top Bond #40	Non-Crete Chem. (Crown Zellerbach)	CAN	Epoxy	Liquid	50-100	77	480		X	X												
PG -2128 LV	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	L-P	55-150	77	20		X				See Remarks	>4250		D-638						
PG-2089	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	Plastic	55-150	72	120-180		X				See Remarks									
PG-2130	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	L-P	35-150	77 77	15 45	Neat Mortar	X				See Remarks	>4200		D-638						
PG-1-228	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	Plastic	55-150	77	120				X		See Remarks	3000		D-638						
1-216 LM Gel	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	Plastic	40-150		50 60	Neat Mortar	X	X	X		See Remarks	>2200		D-638						
PG-2118	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	L-P	>35		15		X				Mortar 10500 C-579	Mortar 1640		C-307						
Plymouth Fast Patch	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	L-P		72	5-10		X				See Remarks	10000								
Uniweld	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	Liquid	40-150	73	120-180		X	X			See Remarks	>3000	14d	D-638				See Remarks		
1-215 HM	Permagile-Salmond (Form & Build Supply)	CAN	Epoxy	Liquid	40-150	73	25-35		X	X	X		See Remarks	>5000	14d	D-638				See Remarks		
Probond 811	Protex (Conchem)	CAN	Epoxy	L-P	Class A <40 Class B 40-60 Class C >60	50 73	36 38	100 g 100 g	X	X										Class B (See Remarks 3360 2d 3425 14d Class C 3400 2d 3424 14d		
Probond 821	Protex (Conchem)	CAN	Epoxy	L-P	Class A <40 Class B 40-60 Class C >60	50 73	36 38	100 g 100 g	X											Class B 3240 14d (2) Class C 3410 14d (2)		

Note: Unless otherwise indicated, all standards refer to "ASTM"
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) ASTM C-884 14d 40-60 deg F

L-P - Liquid to Plastic Consistency

MECHANICAL PROPERTIES													RESISTANCE							
Shear Strength psi age std	Bond Strength psi age std	Flexural Strength psi age std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+5 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volume Change Plastic or Hardened % age std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	
		1440 C-293Mod													
			6.5(Ec) D-695												
		Mortar 4500 C-580		2.3.0 7d D-696											
	See Remarks														
	See Remarks		4.5(Ec) 28d D-695												
	Class B (See Remarks) 3360 2d 3425 14d Class C 3400 2d 3424 14d		Hi Mod			ASTM C-827 CRD 621									
	Class B 3240 14d (2) Class C 3410 14d (2)		Hi Mod			ASTM C-827 CRD 621									

Change for Hardened age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
												Epoxy Binder #38	Patching.
												Top Bond #40	Bonding;
												PG -2128 LV	Patching; Crack Repair. Compressive Str. - 10,000 psi ASTM D-695
												PG-2089	Bonding; Patching; (Horiz, vert, overhead repairs); Use PG-2089 Type "D" for temp. between 35-50. Compressive Str. - 7000 psi ASTM D-695
												PG-2130	Bonding, Crack Repair. Compressive Str. - 10,500 psi ASTM D-695
												PG-1-228	Underwater repair and grouting; vert. and overhead applications Compressive Str. - >7000 psi ASTM D-695
												1-216 LM Gel	Available as "1-216 LM" and "1-216 LM Gel", Both has the same mechanical properties and are used in areas exposed to stress of impact or thermal change. 1-216 LM - Binder for patching, floor toppings, etc. 1-216 LM Gel - Vert. or overhead patching, Compressive Str.- >7500 psi ASTM D-695
												PG-2118	Patching.
												Plymouth Fast Patch	Patching. Compressive Str. 15,000 psi
												Uniweld	Bonding; Apply on vertical or horizonal surfaces; Compressive strength - 10000 psi at 28 days ASTM D-695 Bond strength (Hardened to hardened conc) - Direct shear >375 psi, Direct tension >225 psi, Beam break >700 psi.
												1-215 HM	Available in three grade types: "1-215 HM", "1-215 HM Gel" and "1-215 HM LV; Bonding and patching applications 1-215 HM - Horizonal Surfaces 1-215 HM Gel - Vertical Applications 1-215 HM LV - Spray Applications Compressive strength - 12,500 psi at 28 days (ASTM D-695) Bond strength (Hardened to hardened conc) - Direct shear >400 psi Direct tension >250 psi Beam Break >800 psi
ASTM C-827 CRD 621												Probond 811	This system (811,812,813) conforms to ASTM C-881 Type 1 (ie Bonding hardened conc. to hardened conc., also for use in pressure injection, gravity feed, etc. This system is available in three grades (Grade 1 - spray, roller, brush, injection application.; Grade 2 - brush, broom, squeegee application; Grade 3 - trowel application) with a corresponding temperature range (°F) for each grade (Class A <40; Class B 40-60; Class C >60). Probond 811 - Grade 1, repair crack with 0.005" - 0.25" Probond 812 - Grade 2, repair crack width >0.25" Bond strength 3610 psi (2 days) 2967 psi (14 days) for Class B. Probond 813 - Grade 3, Bond strength 3600 psi (2 days) 2359 psi (14 days) for Class B.
ASTM C-827 CRD 621												Probond 821	This system (821,822,823) conforms to ASTM C-881 Type II (ie Bonding new conc. to hardened conc.) and ASTM C-881 Type 1. The system is available in three grades with the same corresponding temperature range as "Probond 811." Probond 821 - Grade 1, Probond 822 - Grade 2, Bond strength 2970 psi (ASTM C-884 14 days) for Class B. Probond 823 - Grade 3, Bond strength 2360 psi (ASTM C-884 14 days) for Class B.

Q.

TABLE Q
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)
Protex 831	Protex (Conchem)	CAN	Epoxy	L-P	Class A <40 Class B 40-60 Class C >60	50 73	30 35	100 g 100 g	X
AL Bond	Protex (Conchem)	CAN	Acrylic	Liquid	40-82		20		
Vylac 97-314	Protex (Conchem)	CAN	S.B.R Latex	Liquid	40-82		20		
Select Bond GP 1000	Select Products	USA	Epoxy	Liquid	>50	77	150-180		X
Select Bond GP 2000	Select Products	USA	Epoxy	Liquid		77	20-30		X
Select Bond GP 3000	Select Products	USA	Epoxy	Plastic		77	40-45		X
Select Bond GP 5000	Select Products	USA	Epoxy	Liquid	>40	77	25		
Select Bond CS 1043	Select Products	USA	Epoxy	Liquid	>65	77	25-30		X
Select Bond FS 1350 Type I & Type II	Select Products	USA	Epoxy	Liquid	Type I 68-104 Type II 40-68	77	25		X
Select Bond FS 1650 Type I & Type II	Select Products	USA	Epoxy	L-P	Type I 68-104 Type II 40-68	77	30		X
Acryl-Set	Set. Products	USA	Acrylic	L-P	>40				
Infilled Binder	SHELL Canada	CAN	Epoxy Polysulphide	Liquid			30-60		X
Filled Binder	SHELL Canada	CAN	Epoxy Polysulphide	Liquid			30-60		X
Infilled Binder	SHELL Canada	CAN	Epoxy Polyamide	Liquid			60-180		X
Filled Binder	SHELL Canada	CAN	Epoxy Polyamide	Liquid			60-180		X
Infilled Binder	SHELL Canada	CAN	Epoxy Polyamide	Liquid					
Filled Binder	SHELL Canada	CAN	Epoxy Polyamide	Liquid					

Note: Unless otherwise indicated all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

CF - Concrete Fa
L-P - Liquid to P

IALS

ime Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES: Compressive Strength (PSI): 1 Day (std)	7 Day (std)	Tensile Strength: psi age std	Shear Strength: psi age std	Bond Strength: psi age std	Flexural Strength: psi age std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile: 10E+5 psi age std	Coeff. of Thermal Expansion: 10E-6 /F age std	Creep: Result age std	Volume Ch Plastic o %
100 g								Class A			Passes ASTM C-884		Passes
100 g								912 2d					
								Class C					
								750 2d					
								980 14d					
			X		See Remarks						Similar to conc.		
					See Remarks				750		Similar to conc.		
			X		See Remarks						Similar to conc.		
	X				10800 D-695	6600 D-638	2100	500 CF 14d C-882		3.2(Ec) D-695			
	X				13000 D-695	8000 D-638	3200	To Steel		4.6(Ec) D-695			
	X	X			12000 D-695	9800 D-638	2700	7000 14d					
		X			9300 D-695	3600 D-638	2600	>500 CF 14d C-882		4.2(Ec) D-695			
	X						>400	2290 14d C-882		4.3(Ec) D-695			
	X						>400						
		X											
	X			8-10000		3500						Very low	Very low
	X			12-15000		3500						Very low	Very low
	X			6-8000		4000						Very low	Very low
	X			10-13000		4000						Very low	Very low
			X									Very low	Very low
			X									Very low	Very low

F - Concrete Failure
-P - Liquid to Plastic Consistency

Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+5 psi age std	Coeff. of Thermal Expansion 10E-6 /F age std	Creep Result age std	Volume Change Plastic or Hardened % age std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std	PRODUCT NAME	
	Passes ASTM C-884		Passes ASTM C-827 CRD 621									Protem 831	This system (831,832,833 (ie Bonding skid resis and as a binder in epo system is available in range as "Probond 811" Probond 811 - Grade Probond 832 - Grade Bond s Probond 833 - Grade applic (2 day
	Similar to conc.									GOOD	GOOD	XL Bond	Bonding; Additive to Por Compressive Str. - 40
	Similar to conc.											Tylac 97-314	Bonding; Compressive St
3.2(Ec) D-695 4.6(Ec) D-695												Select Bond GP 1000	Bonding.
												Select Bond GP 2000	Bonding, Crack Repair.
4.2(Ec) D-695 4.3(Ec) D-695												Select Bond GP 3000	Bonding, Patching, Crack
												Select Bond GP 5000	Bonding; Patching.
												Select Bond CS 1043	Bonding; (vert. and hori
												Select Bond FS 1350 Type I & Type II	Bonding; Used as a prime
												Select Bond FS 1650 Type I & Type II	Bonding; Crack Repair; H
												Acryl-Set	Patching; Bonding Additi improve, Compressive,
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Unfilled Binder	Patching; Crack Repair; sand. Specifications
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Filled Binder	Patching; Bonding (harde hardened conc) . Setti Specifications US Cor AASHTO Spec. M-200-631
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Unfilled Binder	Patching; Crack Repair; sand. Specifications
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Filled Binder	Patching; Bonding (harde hardened conc) . Setti Specifications AASHTO
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Unfilled Binder	Patching; Applied underw and concrete structur
		Very low	Very low	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	GOOD	GOOD	Filled Binder	Patching; Applied to spl wood and concrete stru

UCT NAME	REMARKS
31	This system (831,832,833) conforms to ASTM C-881 Type III (ie Bonding skid resistant material to hardened conc. and as a binder in epoxy mortars or epoxy concrete). The system is available in three grades with the same temperature range as "Probond 811". Probond 831 - Grade 1, used in horizontal patching Probond 832 - Grade 2, used in horizontal patching, Bond strength 1524 psi (2 days) for Class B. Probond 833 - Grade 3 used in vertical and overhead applications, Bond strength 1549 psi (2 days) for Class B. Bonding; Additive to Portland cement to improve bond. Compressive Str. - 4000 to 5000psi
-314	Bonding; Compressive Str. - 4000 psi
ond GP 1000	Bonding.
ond GP 2000	Bonding, Crack Repair.
ond GP 3000	Bonding, Patching, Crack Repair.
ond GP 5000	Bonding; Patching.
ond CS 1043	Bonding; (vert. and horiz. applications).
ond FS 1350 & Type II	Bonding; Used as a primer.
ond FS 1650 & Type II	Bonding; Crack Repair; Available in two grades.
t	Patching; Bonding Additive for Portland cement to improve, Compressive, Tensile, Flexural & Bond strengths.
Binder	Patching; Crack Repair; Can be used as a mortar base by adding sand. Specifications US Corps MMM-B-350A, MMM-G-650A, and AASHTO Spec. M-200-631
inder	Patching; Bonding (hardened conc. and other mat'ls to hardened conc) . Setting Dowels Specifications US Corps MMM-B-350A, MMM-G-650A, and AASHTO Spec. M-200-631
Binder	Patching; Crack Repair; Can be used as a mortar base by adding sand. Specifications AASHTO Spec. M-200-631
inder	Patching; Bonding (hardened conc. and other mat'ls to hardened conc) . Setting Dowels Specifications AASHTO Spec. M-200-631
Binder	Patching; Applied underwater to protect submerged metal, wood and concrete structures.
inder	Patching; Applied to splash zone to protect submerged metal, wood and concrete structures.

R.

TABLE R
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PR Compressive Strength (PSI) 1 Day (std)	7 Day (std)	Tensile Strength psi	age	std	Shear Strength psi	age	std	Bond Strength psi	age	std
Sonocrete	Sonneborn	USA	Acrylic Latex	Plastic	>40	75	30			X	X											
Sonobond	Sonneborn	USA	Epoxy	Liquid	>50	60 75 90	120 70 30		X	X			See Remarks	3500-4500						1000-1500		
Epolith Patcher	Sonneborn	USA	Epoxy	Plastic	>60	75	120		X				See Remarks									
Epoxy Bonder #6	Specialty Compound	USA	Epoxy	Plastic		77	20-25	100 g	X				11600 D-695	9160	7d	D-638				8380	7d	(2)
Wet Conc. Bonder #38	Specialty Compound	USA	Epoxy	Liquid		77	34-45	100 g	X	X			11590 D-695	3170	7d	D-638				710	14d	
Talygrout 100	Sternson	CAN	Epoxy	P-S	50-86	50 70 80	120 60 42		X			3625	1350	2030	28d	C-190						
Talygrout 200	Sternson	CAN	Epoxy	P-S	50-86	68	30		X			13050	15950									
Talypatch	Sternson	CAN	Epoxy	Plastic	50-86		45		X			2900	7250	1740		C-307						
Urethane Grout W.G (unfilled)	Sternson	CAN	Urethane	Liquid	(-31)-41	-31 -4 41	10-12 5 <1	2.2 L 2.2 L 2.2 L	X			2900	4350									
Urethane Grout W.G. (filled)	Sternson	CAN	Urethane	L-P	(-31)-41		5-15		X			2900	3770									
Urethane Grout S.G. (unfilled)	Sternson	CAN	Urethane	Liquid	>14	14 50 90	15-20 7-10 2-4	2.2 L 2.2 L 2.2 L	X			3335	4785	3045			870					
Urethane Grout S.G. (filled)	Sternson	CAN	Urethane	L-P	>14		2-10		X			3335	3915	3045								
Acryl 60	Thoro System	CAN	Acrylic	Liquid	>45		20						2995 C-109	598	7d					450	7d	C-321
Thoro Polymer Conc.	Thoro System	CAN	Acrylic/ Aggre-gates	Plastic	>35	70	60		X				See Remarks	1500								
Experimental XUS 40046	Dow Chemicals	CAN	Polyamide Alkyd	Plastic	50-100		3-120		X			14000		1300-1550			450-525			3000-4000		
Experimental XUS 40047	Dow Chemicals	CAN	Polyamide Alkyd	Plastic	50-100		3-120		X			12000		1100-1300			400-450			2000-4000		
Experimental XUS 40048	Dow Chemicals	CAN	Polyamide Alkyd	Plastic	50-100		3-120		X			10000		800-1200			475-525			1800-2400		

Note: Unless otherwise indicated all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) AASHTO T-237

L - Litres
P-S - Plastic to Slurry
L-P - Liquid to Plastic
G-E - Good to Excellent

| MECHANICAL PROPERTIES | | |

ume Change % tic or Hardened age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
												Sonocrete	Bonding; Patching (Horizontal and Vertical); Crack Repair; Admixture in concrete mortar.
												Sonobond	Bonding. Compressive Str. - 7000 to 9000 psi
												Epolith Patcher	Patching; Crack Repair. Service temperature range (-40)F to 180F ; Compressive Str. - 9000 to 10,000 psi
												Epoxy Bonder #6	Bonding, Crack Repair
												Wet Conc. Bonder #38	Bonding;
												Talygrout 100	Grouting (used in areas with extreme vibrations or dynamic torque).
												Talygrout 200	Grouting; Patching.
												Talypatch	Patching; Crack Repair. not recommended in areas subjected to sudden extreme temperature changes.
												Urethane Grout W.G (unfilled)	Grouting, Crack Repair, Winter Grade.
												Urethane Grout W.G. (filled)	Patching; Grouting, Winter Grade.
												Urethane Grout S.G. (unfilled)	Grouting; Crack Repair; Summer Grade.
												Urethane Grout S.G. (filled)	Patching, Grouting.
												Acryl 60	Additive for portland cement; Bonding agent for Thoroseal Mechanical properties are based on a cement-sand mortar, modified with with "Acryl 60"
												Thoro Polymer Conc.	Patching. Compressive Str. - 6000psi
		GOOD	POOR	GOOD	GOOD	GOOD		0.05-.1g	C-944			Experimental XUS 40046	Polymer concrete (filled system) used for: piping, large castings, floors, marine and bridges; high temp. corrosion.
		GOOD	POOR	GOOD	POOR	GOOD		0.1-0.2g	C-944			Experimental XUS 40047	Polymer concrete (filled system) used for: highway repair, floors; flexible; Good in dilute acids;
		GOOD	POOR	GOOD	GOOD	GOOD		0.2-0.3g	C-944			Experimental XUS 40048	Polymer concrete (filled system) used for: piping, large castings, floors, marine and bridges; high temp. corrosion.

S.

TABLE 5
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size
Experimental XUS 40047.15	Dow Chemicals	CAN	Polyamide Alkyd	Plastic	50-100		3-120	
Derakane 411-C50	Dow Chemicals	CAN	Vinyl Ester	Plastic	60-90		5-120	
Derakane 8084.05	Dow Chemicals	CAN	Vinyl Ester	Plastic	60-90		5-120	
Derakane XP 71717	Dow Chemicals	CAN	Vinyl Ester	Plastic	60-90		5-120	
Derakane XP 71765	Dow Chemicals	CAN	Vinyl Ester	Plastic	60-90		5-120	
Magma-Quartz	Balzona Molecular Metalife Inc.		Resin	Screed - Liquid	-60 to +180	70	60	15 Kg
IG-100	Prime Resins Inc.		Epoxy	Fluid	50-100	??	60	3 fl.oz.
PBG-R	Prime Resins Inc.		Epoxy	Gel	40-100	??	30	3 fl.oz.
PB-25	Prime Resins Inc.		Epoxy	Gel	40-100	??	40	3 fl.oz.
PB-25 -winter	Prime Resins Inc.		Epoxy	Gel	10-80	40	40	3 fl.oz.
PB-25 -underwater	Prime Resins Inc.		Epoxy	Gel	40-100	??	25	3 fl.oz.
PB-50	Prime Resins Inc.		Epoxy	Gel	40-100	??	30	3 fl.oz.
PB-11	Prime Resins Inc.		Epoxy	Fluid	40-100	??	25	3 fl.oz.
PB-12	Prime Resins Inc.		Epoxy	Fluid	10-80	??	11	3 fl.oz.
PB-17	Prime Resins Inc.		Epoxy	Fluid	40-100	??	31	3 fl.oz.
PB-41	Prime Resins Inc.		Epoxy	Fluid	40-100	??	40	3 fl.oz.
PB-51	Prime Resins Inc.		Epoxy	Fluid	40-100	??	45	3 fl.oz.
PB-47	Prime Resins Inc.		Epoxy	Gel	40-100	??	25	3 fl.oz.
PB-48	Prime Resins Inc.		Epoxy	Fluid	40-100	??	25	3 fl.oz.
PB-III	Prime Resins Inc.		Epoxy	Gel	40-100	??	40	3 fl.oz.
Wet Bond #1	Prime Resins Inc.		Epoxy	Fluid	40-100	??	40	3 fl.oz.
Fast Lane Grout	Prime Resins Inc.		Epoxy	Paste	30-100	??	16	3 fl.oz.
JS-77-D	Prime Resins Inc.		Epoxy	Fluid	40-100	??	45	3 fl.oz.
HCR	Prime Resins Inc.		Epoxy	Paste	50-100	??	60	3 fl.oz.
XLV Speed Cure	Prime Resins Inc.		Epoxy	Fluid	10-100	??	5	3 fl.oz.
Dynabond I	American Chemical	CAN.	Acrylic	Fluid	50	68	180	4 oz
Dynabond II	American Chemical	CAN.	Water - based epoxy	Fluid	50	68	120	4 oz

Note: Unless otherwise indicated all standards refer to "ASTM". CF - Concr
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.

ING MATERIALS

| PLACEMENT | | | | | MECHANICAL PROPERTIES (1) | | | | |

of Thermal ansion		Creep			Volume Change			RESISTANCE									PRODUCT NAME	REMARKS
/F	age	std	Result	age	std	Plastic or Hardened %	age	std	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std		
.3									POOR	POOR	GOOD	POOR	GOOD		0.1-0.2g	C-944			Experimental XUS 40047.15	Polymer concrete (filled system) used for: highway repair floors; Flexible;
7.0									GOOD	GOOD	GOOD	POOR	GOOD		0.3g	C-944			Derakane 411-C50	Polymer concrete (filled system) used for: casting, floor marine; High temperature corrosion
												POOR	GOOD						Derakane 8084.05	Polymer concrete (filled system) used for: casting, floor marine;
.0									GOOD	GOOD	GOOD	POOR	GOOD		0.1-0.3g	C-944			Derakane XP 71717	Polymer concrete (filled system) used for: casting, floor marine; High temperature corrosion
.5									GOOD	POOR	GOOD	POOR	GOOD		0.05-0.1g	C-944			Derakane XP 71765	Polymer concrete (filled system) used for: casting, floor marine;
									EXCEL	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL					Magma-Quartz	Abrasion = 0.2 g removed per 1,000 cycles, using Taber Ab with CS17 wheels and 1 Kg load
7	d	D-696			-1.8	7	d		FAIR	FAIR	EXCEL	FAIR	0.75 %				5, Pass	C-884	IG-100	100 % Elongation injection Shore Hardness = 65-A
7	d	D-696			-2.1	7	d		GOOD	GOOD	EXCEL	GOOD	0.10 %				5, Pass	C-884	PBG-R	Non-sag, rigid structural adhesive Shore Hardness = 84-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.35 %				5, Pass	C-884	PB-25	Gel adhesive; Vertical spall repair Shore Hardness = 73-D
3	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.30 %				5, Pass	C-884	PB-25 -winter	Gel adhesive; Vertical spall repair Shore Hardness = 73-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	PB-25 -underwater	Gel adhesive; Splash zone repair Shore Hardness = 77-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.30%				5, Pass	C-884	PB-50	Gel adhesive; 50 % elongation Shore Hardness = 60-D
7	d	D-696			-2.1	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	PB-11	Bonder; Old to plastic concrete Shore Hardness = 79-D
7	d	D-696			-2.2	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	PB-12	Cold temperature grout and overlay Shore Hardness = 79-D
7	d	D-696			-2.1	7	d		FAIR	FAIR	EXCEL	GOOD	0.25 %				5, Pass	C-884	PB-17	Skid resistant overlay Shore Hardness = 45-D
7	d	D-696			-2.0	7	d		FAIR	FAIR	EXCEL	GOOD	0.25 %				5, Pass	C-884	PB-41	Thermal shock resistant overlay Shore Hardness = 58-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.25 %				5, Pass	C-884	PB-51	Setting reinforcements into concrete Shore Hardness = 60-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.15 %				5, Pass	C-884	PB-47	Vertical grout gel; 35 % elongation Shore Hardness = 65-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	PB-48	Sealing pile jacket bottoms Shore Hardness = 55-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	PB-III	Gel adhesive; Concrete to steel etc. Shore Hardness = 60-D
7	d	D-696			-2.1	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	Wet Bond #1	Bonding; Old to plastic concrete and grout Shore Hardness = 81-D
7	d	D-696			-1.3	7	d		FAIR	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	Fast Lane Grout	Anchoring and base plate grouting Shore Hardness = 70-D
7	d	D-696			-2.0	7	d		GOOD	GOOD	EXCEL	GOOD	0.20 %				5, Pass	C-884	JS-77-D	Flooring; Trowel at any sand loading Shore Hardness = 77-D
7	d	D-696			-1.4	7	d		EXCEL	EXCEL	EXCEL	EXCEL	0.10 %				5, Pass	C-884	HCR	Chemically resistant coating; Trowel Shore Hardness = 85-D
7	d	D-696			-2.3	7	d		GOOD	GOOD	EXCEL	GOOD	0.15 %				5, Pass	C-884	XLV Speed Cure	Crack repair; Full properties fast Shore Hardness = 80-D
									POOR	GOOD	POOR	POOR	EXCEL	EXCEL	7.0 litres/mil minimum				Dynabond I	Coating over steel; Patching
									POOR	EXCEL	EXCEL	EXCEL	EXCEL	EXCEL					Dynabond II	Water based epoxy system excellent overcoat and waterproo for sandblasted metal or protecting concrete

ME	REMARKS
0	Polymer concrete (filled system) used for: highway repair, floors; Flexible;
5	Polymer concrete (filled system) used for: casting, floors, marine; High temperature corrosion
17	Polymer concrete (filled system) used for: casting, floors, marine;
65	Polymer concrete (filled system) used for: casting, floors, marine; High temperature corrosion
	Polymer concrete (filled system) used for: casting, floors, marine;
	Abrasion = 0.2 g removed per 1,000 cycles, using Taber Abraser with CS17 wheels and 1 kg load
r	100 % Elongation injection Shore Hardness = 65-A
	Non-sag, rigid structural adhesive Shore Hardness = 84-D
	Gel adhesive; Vertical spall repair Shore Hardness = 73-D
	Gel adhesive; Vertical spall repair Shore Hardness = 73-D
water	Gel adhesive; Splash zone repair Shore Hardness = 77-D
	Gel adhesive; 50 % elongation Shore Hardness = 60-D
	Bonder; Old to plastic concrete Shore Hardness = 79-D
	Cold temperature grout and overlay Shore Hardness = 79-D
	Skid resistant overlay Shore Hardness = 45-D
	Thermal shock resistant overlay Shore Hardness = 58-D
	Setting reinforcements into concrete Shore Hardness = 60-D
	Vertical grout gel; 35 % elongation Shore Hardness = 65-D
	Sealing pile jacket bottoms Shore Hardness = 55-D
	Gel adhesive; Concrete to steel etc. Shore Hardness = 60-D
	Bonding; Old to plastic concrete and grout Shore Hardness = 81-D
t	Anchoring and base plate grouting Shore Hardness = 70-D
	Flooring; Trowel at any sand loading Shore Hardness = 77-D
	Chemically resistant coating; Trowel Shore Hardness = 85-D
	Crack repair; Full properties fast Shore Hardness = 80-D
	Coating over steel; Patching
	Water based epoxy system excellent overcoat and waterproofing for sandblasted metal or protecting concrete

T.

TABLE T
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Working Time Time min	Working Time Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROP Compressive Strength (PSI) 1 Day (std)	Compressive Strength (PSI) 7 Day (std)	Tensile Strength psi	Tensile Strength age	Tensile Strength std	Shear Strength psi	Shear Strength age	Shear Strength std	Bond Strength psi	Bond Strength age	Bond Strength std
Ceva Patch 120	E-Poxy Indust.Inc	USA	Elastomer		45-100	77	30	200 g	X	X			2,100 D-695	655	7 d	D-638	800	7 d		560	7 d	
Ceva Deck	E-Poxy Indust.Inc	USA	Resin		45-100	77	30	200 g	X	X		2,170 D-695		420	1 d	D-638	2010	2 d				
Evapon Bonder #1	E-Poxy Indust.Inc	USA	Plastic-Res.amine	Resin	30-100	77	30	200 g	X	X			7,000 D-695	3,500	7 d	D-638						
Evapon Bonder #2	E-Poxy Indust.Inc	USA	Plastic-Res.amine	Resin	30-100	77	120-180	200 g	X	X			9,000 D-695	3,500	7 d	D-638				650	7 d	(2)
Evapon Mortar Min-#3	E-Poxy Indust.Inc	USA	Epoxy-Amine	Mortar	40-100	77	50	200 g	X	X		7,000 D-695		2,500	7 d	D-638						
Evapon Epoxy Paste-#22	E-Poxy Indust.Inc	USA	Epoxy-Amine	Paste	50-100	77	40					6,000 D-695		12,000	7 d	D-638						
Evapon Hi Mod Gel	E-Poxy Indust.Inc	USA	Epoxy-Amine	Gel	30-100	77	5						15,000 D-695	7,000	7 d	D-638						
Evapon Chemical - Resistant Coating	E-Poxy Indust.Inc	USA	Epoxy-Amine	Resin	40-100	77	40															
Q-Stik 102 - Summer grade	Chemque Canada	CAN.	Epoxy	Paste	40-95	72	240-300	100 g	X	X			10,000 D-695	6,200	7 d	D-638	4,700	7 d	D-1002-49	3,300	8 d	C-882
Q-Stik 102 - Winter grade	Chemque Canada	CAN.	Epoxy	Paste	32-55	32	180-240	100 g	X	X			8,200 D-695	9,000	7 d	D-638	4,920	7 d	D-1002-49	3,300	8 d	C-882
Q-Stik 103 - Summer grade	Chemque Canada	CAN.	Epoxy	Medium-Liquid	40-95	72	60-120	100 g	X	X			3,200 C-882	6,000	7 d	D-638	3,900	7 d	D-1002-49	4,700	2 d	C-882
Q-Stik 103 - Winter grade	Chemque Canada	CAN.	Epoxy	Medium-Liquid	32-55	32		100 g	X	X			12,000 D-695	6,700	7 d	D-638	4,250	7 d	D-1002-49	4,700	2 d	C-882
Q-Stik 115	Chemque Canada	CAN.	Epoxy	Gel	40-95	72	30-40	100 g	X	X			12,000 D-695	5,800	7 d	D-638	3,000	7 d	D-1002-49	3,700	2 d	C-882
Q-Stik 117	Chemque Canada	CAN.	Epoxy	Gel	40-95	72	3-4	100 g	X	X							2,400	7 d	D-1002-49	2,750	2 d	C-882
Q-Stik 119	Chemque Canada	CAN.	Epoxy	Gel	40-95	72	15-20	100 g	X	X	X						1,500	7 d	D-1002-49	1,740	2 d	C-882
Q-Stik 120	Chemque Canada	CAN.	Epoxy	Liquid	40-95	72	20-25	100 g	X	X			13,900 C-109-75	1,200	7 d	C-190-72	4,000	7 d	D-1002-49			
Q-Stik 153/154	Chemque Canada	CAN.	Epoxy	Liquid	40-95	72	25-30	100 g	X	X							4,400	7 d	D-1002-49			
Q-Seal 200	Chemque Canada	CAN.	Acrylic	Liquid	40-95	72	15-30		X													
Q-Seal 229	Chemque Canada	CAN.	Epoxy	Liquid	40-95	72	30-40	100 g	X													
Q-Cote 300/301	Chemque Canada	CAN.	Epoxy	Liquid	40-95	72	240-300	100 g	X													
Q-Cote 310/315/320	Chemque Canada	CAN.	Urethane	Liquid	55-90				X													
Q-Mod 450	Chemque Canada	CAN.	Acrylic	Liquid	45-95								5,700 28 d air-cured	615	28 d	air-cured	650	28 d	air-cured			
Feb Epoxy Grout #4	F.E.B.		Epoxy	Mortar	41-113	68	30	10 Kg		X	X		14,200	2,600	7 d							
Febset NF	F.E.B.		Epoxy	Mortar	41-113	50	40	3 Kg		X	X		7,100	2,100	7 d							
Febgrout	F.E.B.		Additive	Powder	45-113	68	60	225 g			X		3,530 -using 1:1 Sand/Cement grout									
Febond SBR	F.E.B.		S.B.R.	Liquid	41-113	68	30				X	Up to 10,000	Up to 940				4,495	14 d				
Febweld	F.E.B.		Epoxy	Liquid	41-113	68	40	2 L			X											
Febond P.V.A.	F.E.B.		PVAC	Liquid	41-113	68	20													2,900	7 d	
Feb Supercrete	F.E.B.		Polyester	Mortar	41-113	68	15	15 Kg		X	X	11,300	14,350	1,690	24 hr					1,300	7 d	

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) AASHTO T23733

L - Litres

MECHANICAL PROPERTIES

ength		Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) - Compressive (Et) - Tensile			Coeff. of Thermal Expansion			Creep			Volume Change		
ge	std	psi	age	std	psi	age	std	10E+5 psi	age	std	10E-6 /F	age	std	Result	age	std	Plastic or Hardened %	age	std
7 d		560	7 d																
2 d																			
		650	7 d	(2)				6											
D-1002-49		3,300	8 d	C-882															
D-1002-49		3,300	8 d	C-882															
D-1002-49		4,700	2 d	C-882															
D-1002-49		4,700	2 d	C-882															
D-1002-49		3,700	2 d	C-882															
D-1002-49		2,750	2 d	C-882															
D-1002-49		1,740	2 d	C-882															
D-1002-49																			
D-1002-49					7,400	7 d													
d air-cured					1,580	28 d	air-cured												
					4,930	7 d													
d		2,900	7 d		Up to 1885						12.8								
		1,300	7 d		5,365	7 d													

RESISTANCE									
Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze cycles	
EXCEL	EXCEL	EXCEL	GOOD	EXCEL					
EXCEL	EXCEL	EXCEL	GOOD	EXCEL					
EXCEL	EXCEL	EXCEL	GOOD	EXCEL					
EXCEL	EXCEL	EXCEL	GOOD	EXCEL					
EXCEL	EXCEL	EXCEL	GOOD	EXCEL					
R	R	R	R	R	R				
R	R	R	R	R	R				
S	S	S	S	R	R				
R	R	R	R	R	R				
R	R	R	R	R	R				
S	R	R	R	R	R			60 - 102	

R - Resistant
S - Occasional Spillage

lume Change astic or Hardened % age std	RESISTANCE								PRODUCT NAME	REMARKS
	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result std	Freeze/Thaw cycles std		
	EXCEL	EXCEL	EXCEL	GOOD	EXCEL				Cava Patch 120	Parking deck repair; Quick patching; Elastomeric, excellent bond to substrates.
	EXCEL	EXCEL	EXCEL	GOOD	EXCEL				Cava Deck	Deck overlay; Elastomeric, excellent bond to substrates.
	EXCEL	EXCEL	EXCEL	GOOD	EXCEL				Evapon Bonder #1	Cured concrete to concrete bonder.
	EXCEL	EXCEL	EXCEL	GOOD	EXCEL				Evapon Bonder #2	Fresh concrete to cured concrete bonder.
	EXCEL	EXCEL	EXCEL	GOOD	EXCEL				Evapon Mortar Min-#3	Patching and/or anchor grouting.
									Evapon Epoxy Paste-#22	Quick setting anchor grouting: Patching.
									Evapon Hi Mod Gel	Sealing, concrete protective covering.
									Evapon Chemical - Resistant Coating	
									Q-Stik 102 - Summer grade	Bonding new concrete to old.
									Q-Stik 102 - Winter grade	Bonding new concrete to old.
									Q-Stik 103 - Summer grade	Bonding new concrete to old.
									Q-Stik 103 - Winter grade	Bonding new concrete to old.
									Q-Stik 115	Epoxy bonder; Applying injection "T's"; Sealing cracks and small patches.
									Q-Stik 117	Epoxy bonder; Applying injection "T's"; Sealing cracks and small patches.
									Q-Stik 119	Epoxy bonder; Applying injection "T's"; Sealing cracks and small patches.
									Q-Stik 120	Epoxy binder mixed with aggregate for patching concrete, and anchor grouting.
									Q-Stik 153/154	Epoxy binder mixed with aggregate for patching concrete, and anchor grouting.
									Q-Seal 200	Acrylic concrete sealer for old and new work, also wood and brick.
									Q-Seal 229	Epoxy penetrating sealer for concrete and masonry.
									Q-Cote 300/301	Epoxy smooth (301) and non-slip (300) floor coating, -clear and pigmented.
									Q-Cote 310/315/320	Floor coating; Fast drying, chemical resistant, -clear and pigmented.
									Q-Mod 450	Acrylic cement modifier to add flexural, adhesive, and impact strengths to concrete.
	R	R	R	R	R	R			Feb Epoxy Grout #4	Pourable; Mix using suitable mixer.
	R	R	R	R	R	R			Febset NF	Trowel; Non-flow material - suitable as a bedding compound.
	S	S	S	S	R	R			Febgrout	Pourable; Cement-additive to sand/cement giving expansion.
	R	R	R	R	R	R		60 - 10% Brine	Febond SBR	Cement/concrete additive for bonding and patching.
	R	R	R	R	R	R			Febweld	Brush; Bonding agent - May be used in conjunction with "Feb Expan".
									Febond P.V.A.	Brush; Bonding agent/sealer coat.
	S	R	R	R	R	R			Feb Supercrete	Trowel applied patching; Portion of filler catalyst can be varied to give different consistency.

R - Resistant
S - Occasional Spillage

U.

TABLE U
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

PRODUCT NAME	MANUFACTURE (Canadian Distributors) NAME	Origin	Generic Type	PLACEMENT Consistency	Temp. Range Deg F	Working Time Temp. Deg F	Time min	Sample Size	Dry <1?
TremTech - V	Tremco	CAN	Acrylic Latex	Paste	50 +	77	20	22 Kg	X
TremTech Gel	Tremco	CAN	Acrylic Latex	Gel	50 +	77	30	18 Kg	X
TremTech MM	Tremco	CAN	Acrylic Latex	Trowel	50 +	77	15	35 Kg	X
TremTech SL	Tremco	CAN	Acrylic Latex	Self - Level	50 +	77	15	23 Kg	X
Trem Mort. Com. A	Tremco	CAN	Acrylic Latex	Liquid	50 +	77	40	35 Kg	X
TremCrete	Tremco	CAN	Acrylic Latex	Brush	50 +	77	30	300 g	X
TremLiner	Tremco	CAN	Epoxy	Gel	41-86	77	240	1 Kg	X
TremEpoxy Gel	Tremco	CAN	Epoxy	Gel	41-86	77	30	150 g	X
TremEpoxy CBS (Std)	Tremco	CAN	Epoxy	Medium Visc.	41-86	77	35	150 g	X
TremEpoxy CBS (Slow Set)	Tremco	CAN	Epoxy	Medium Visc.	41-86	77	360	150 g	X
TremEpoxy MB	Tremco	CAN	Epoxy	Plastic	41-86	77	60	1 Kg	X
Trem Epoxy CBA	Tremco	CAN	Epoxy	Liquid	>41	68 95	35-45 20-25		X
TremEpoxy S	Tremco	CAN	Epoxy	Plastic	41-86	77	60	1 Kg	X
TremEpoxy Primer	Tremco	CAN	Epoxy	Liquid	41-86	77	300	150 g	X
TremFlor Overlayment	Tremco	CAN	Epoxy	Trowel	41-86	77	75	150 g	On P
TremFlor Primer	Tremco	CAN	Epoxy	Liquid	41-86	77	360	150 g	X
Trem Flor Sealer	Tremco	CAN	Epoxy	Liquid	41-86	77	360	150 g	X
TremFlor Hi Build	Tremco	CAN	Epoxy	Liquid	41-86	77	45	150 g	X
S-B Bonding Agent	Hey'Di American Deutsche Hey'Di	USA Germany	Styrene - butadiene	Liquid	39 +				
SK 2000 S	Deutsche Hey'Di	Germany	Additive Thermo-Plastics	Sheet	39-176	Normal	12 hrs		X
E.C.B.	Deutsche Hey'Di	Germany	Thermo-Plastics	Sheet					X

Note: Unless otherwise indicated, all standards refer to "ASTM".
Where blanks are shown, no information has been supplied by the manufacturer.
(1) The notation "X" indicates that the product is recommended by the manufacturer for use under this condition.
(2) New to Old Concrete

Dry (1)	Sample Size	Dry (1)	Damp (1)	Wet (1)	MECHANICAL PROPERTIES																											
					Compressive Strength (PSI)						Tensile Strength			Shear Strength			Bond Strength			Flexural Strength			Modulus of Elasticity (Ec) - Compressive (Et) - Tensile			Coeff. of Thermal Expansion			Creep			Volume Change		
					1 Day	(std)	7 Day	(std)	psi	age	std	psi	age	std	psi	age	std	psi	age	std	10E+5 psi	age	std	10E-6 /F	age	std	Result	age	std	Plastic or H		
																														%	age	
X	Kg	X	X		1,650	C-109	3,600	C-109	700	28 d	C-190	2,600	28 d	C-882				1,500	28 d	C-348				1.99	28 d	C-531				0.057	28 d	
X	Kg	X	X		1,000	C-109	1,800	C-109	500	28 d	C-190	950	28 d	C-882				900	28 d	C-348				3.78	28 d	C-531				0.099	28 d	
X	Kg	X	X		1,700	C-109	4,500	C-109	900	28 d	C-190	2,100	28 d	C-882				1,200	28 d	C-348				2.60	28 d	C-531				0.067	28 d	
X	Kg	X	X		1,650	C-109	4,500	C-109	750	28 d	C-190	2,200	28 d	C-882				2,000	28 d	C-348				3.31	28 d	C-531				0.096	28 d	
X	Kg	X	X																													
X	g	X	X																													
X	Kg	X	X		11,950	C-109	13,275	C-109	2,000	7 d								5,425	7 d		18.2	7 d										
X	g	X	X									2,000 (2)	14 d	C-882																		
X	g	X	X									2,200 (2)	14 d	C-882																		
X	g	X	X									2,140 (2)	14 d	C-882																		
X	Kg	X			6,200	C-109	7,772	C-109	1,288	7 d								3,306	7 d													
X		X	X				See Remarks		2900			3625						5076														
X	Kg	X			9,950	C-109	12,204	C-109	1,315	7 d								4,700	7 d													
X	g	X																														
On Pr	g	On Primer			9,000	C-109	12,000	C-109	2,200	14 d	C-190							4,500	14 d	C-580				11.9	28 d	C-531				0.012	14 d	
X	g	X																														
X	g	X																														
X	g	X																														
		X							400		D-412							678	7 d	C-580	9.22		C-580									
X		X							411		D-412										100 KP/cm^3		DIN 53 457									

ticity ive std	Coeff. of Thermal Expansion 10E-6 /F	age	std	Creep Result	age	std	Volume Change Plastic or Hardened %	age	std	RESISTANCE Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	std	Freeze/Thaw cycles	std	PRODUCT NAME	REMARKS
	1.99	28 d	C-531				0.057	28 d	C-531	A	A	A	C	A		3.2 g	D-4060			TremTech - V	Vertical repair mortar; Latex modified cem
	3.78	28 d	C-531				0.099	28 d	C-531	A	A	A	C	A		6.0 g	D-4060			TremTech Gel	Overhead repair mortar; Latex modified cem
	2.60	28 d	C-531				0.067	28 d	C-531	A	A	A	C	A		8.0 g	D-4060			TremTech HM	Horizontal repair mortar; Latex modified c
	3.31	28 d	C-531				0.096	28 d	C-531	A	A	A	C	A		2.5 g	D-4060			TremTech SL	Self-levelling repair mortar; Latex modifi
																				Trem Mort. Com. A	Liquid component for above four products.
										A	A	A	C	A						TremCrete	Latex modified cementitious waterproof coa
										A	A	A	A	A				5-passed	C-884	TremLiner	Trowellable epoxy mortar; Non-sag.
										A	A	A	A	A						TremEpoxy Gel	Non-sag epoxy bonding agent for concrete a insensitive.
										A	A	A	B	A						TremEpoxy CBS (Std)	Moisture insensitive, 100% solids epoxy co agent (Std).
										A	A	A	B	A						TremEpoxy CBS (Slow Set)	Moisture insensitive, 100% solids epoxy co agent (Slow Set).
										A	A	A	B	A				5-passed	C-884	TremEpoxy HB	High build epoxy mortar for vertical and o Prime surface with "TremEpoxy Primer" be
																				Trem Epoxy CBA	Bonding (Horiz. or vert. surfaces); Available in standard or slow set. Compressive Str. - 7250psi
										A	A	A	B	A				5-passed	C-884	TremEpoxy S	High build epoxy mortar for horizontal sur Prime surface with "TremEpoxy Primer" be
										A	A	A	A	A				5-passed	C-884	TremEpoxy Primer	Epoxy concrete primer for use with epoxy m
	11.9	28 d	C-531				0.012	14 d	C-531	A	A	A	A	A		1.74 g	Taber	5-passed	C-884	TremFlor Overlayment	Trowel applied, heavy duty epoxy surfacer
										A	A	A	A	A						Tremflor Primer	Epoxy concrete primer for use with epoxy m
										A	A	A	B	A		0.045 g	Taber			Trem Flor Sealer	Thin set epoxy coating for concrete, mason
										A	A	A	B	A		0.070 g	Taber			TremFlor Hi Build	Hi-build epoxy coating for concrete, mason
C-580																				S-B Bonding Agent	Admixture in water of Hey'Di K-11, Powder Improves the adhesion, elasticity and ab
																				SK 2000 S	Positive waterproofing for below and above landscape, parking decks etc.; Non-traff Must be protected.
DIN 53 457																				E.C.B.	For critical waterproofing and roofing.

A - Intact, Unaffected
B - Intact, Abrades Readily
C - Soft, Rubbery Mass

NAME	REMARKS
V	Vertical repair mortar; Latex modified cement.
Gel	Overhead repair mortar; Latex modified cement.
HM	Horizontal repair mortar; Latex modified cement.
SL	Self-levelling repair mortar; Latex modified cement.
Com. A	Liquid component for above four products.
	Latex modified cementitious waterproof coating.
	Trowellable epoxy mortar; Non-sag.
Gel	Non-sag epoxy bonding agent for concrete and steel; Moisture insensitive.
CBS (Std)	Moisture insensitive, 100% solids epoxy concrete bonding agent (Std).
CBS (Slow Set)	Moisture insensitive, 100% solids epoxy concrete bonding agent (Slow Set).
HB	High build epoxy mortar for vertical and overhead surfaces. Prime surface with "TremEpoxy Primer" before application.
CBA	Bonding (Horiz. or vert. surfaces); Available in standard or slow set. Compressive Str. - 7250psi
S	High build epoxy mortar for horizontal surfaces. Prime surface with "TremEpoxy Primer" before application.
Primer	Epoxy concrete primer for use with epoxy mortars.
verlayment	Trowel applied, heavy duty epoxy surfacer for concrete.
Primer	Epoxy concrete primer for use with epoxy mortars.
Sealer	Thin set epoxy coating for concrete, masonry and steel.
Hi Build	Hi-build epoxy coating for concrete, masonry and steel.
ng Agent	Admixture in water of Hey'Di K-11, Powder #1 and Polymer conc. Improves the adhesion, elasticity and abrasiveness.
	Positive waterproofing for below and above grade, under landscape, parking decks etc.; Non-traffic bearing. Must be protected.
	For critical waterproofing and roofing.

V.

TABLE V
ORGANIC MATERIAL - PATCHING AND BONDING MATERIALS

| PRODUCT NAME | MANUFACTURE (Canadian Distributors) | | Generic Type | PLACEMENT | | | | | | | | MECHANICAL PROPER | | | | | | | |

MECHANICAL PROPERTIES

Bond Strength psi	age	std	Flexural Strength psi	age	std	Modulus of Elasticity (Ec) - Compressive (Et) - Tensile 10E+5 psi	age	std	Coeff. of Thermal Expansion 10E-6 /F	age	std	Creep Result	age	std	Volume Change Plastic or Hardened %	age	std
1,886	14 d	C-882	7,397	14 d	D-790	4.9	28 d	D-695									
2,756	2d Dry C-882		13,925	14 d	D-790	4.1	28 d	D-695									
2,756	14dy Damp																
1,741	2d Dry C-882		2,321	14 d	D-790	7.7	28 d	D-695									
1,450	14d Moist		Mortar 1:3.25			Mortar 1:3.25											
2,321	2d Dry C-882		2,901	14 d	D-790	4.6	28 d	D-695									
2,031	14dy Moist		Mortar 1:2.25			Mortar 1:2.25											
725	2d Dry C-882		2,176	14 d	D-790	1.6	28 d	D-695									
1,015	14d Moist		Mortar 1:1			Mortar 1:1											
3,336	Conc. Dry		4,496	14 d	D-790	11.0	28 d	D-695									
3,796	Conc. SSD																
3,481	Steel Dry																
3,336	Conc. Dry			14 d	D-790	10.0	28 d	D-695									
2,321	Conc. SSD																
3,626	Steel Dry																
2,321	Steel Wet																
653	14 d		3,191	14 d	D-790	8.0	28 d	D-695									
Underwater			3,916	14 d	D-790	5.5	28 d	D-695									
			5,077	14 d	D-790	7.0	28 d	D-695									
2,321	2 d	C-882		14 d	D-790		28 d	D-695									
3,046	14 d		2,466	-neat		5.2	-neat										
			3,046	-mortar		10.0	-mortar										

RESISTANCE										
Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std	PR
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
FAIR	FAIR		F-P	GOOD						Sikad
			F-P	GOOD						Sikad
										Sikad
										Sikad Wat
FAIR	FAIR		F-P	GOOD						Sikad
				GOOD	Must Never Dry					Sikad

SD - Saturated Surface Dry

F-P - Fair to Poor

Volume Change Plastic or Hardened % age std	RESISTANCE									PRODUCT NAME	REMARKS
	Acid	Base	Oil	Solvent	Water	Wetting Drying	Abrasion Result	Abrasion std	Freeze/Thaw cycles	Freeze/Thaw std		
	FAIR	FAIR		F-P	GOOD						Sikadur Hi-Mod	Bonding, adhesive, patching mortar, potting compound, overlays; Crack repair.
	FAIR	FAIR		F-P	GOOD						Sikadur Hi-Mod LV	Overlays with sand, injecting cracks, Hi-Modulus mortar topping, sealing slabs (inside). Compressive Str. - 11750 psi Above and underwater use.
	FAIR	FAIR		F-P	GOOD						Sikadur Lo-Mod LV	Lo modulus overlays, broadcast or mortar toppings, sealing slabs (inside).
	FAIR	FAIR		F-P	GOOD						Sikadur Lo-Mod	Adhesive for Lo-Mod broadcast.
	FAIR	FAIR		F-P	GOOD						Sikadur Lo-Mod Gel	Gap filling Lo-Mod adhesive, non-structural repair mortars; Vertical or overhead.
	FAIR	FAIR		F-P	GOOD						Sikadur 42 (Grout Pak)	Machine base, crane rail and anchor bolt grouting; Toppings.
	FAIR	FAIR		F-P	GOOD						Sikadur 43 (Patch Pak)	Patching and repair of concrete structures.
				F-P	GOOD						Sikadur 45 Marine Grout Pak	Underwater work, pile jacketing etc.
											Sikagard 694	For repair of concrete or steel piles, in splash zone or underwater.
											Sikagard 70 Water Repellant Impregnation	Water repellant impregnation (in depth) to protect steel from chloride attack etc. and for general waterproofing; Does not inhibit breathing.
	FAIR	FAIR		F-P	GOOD						Sikadur 31	Bonding (overhead and vertical); Crack Repair; Compressive str. - 11,020psi 28 days.
					GOOD	Must Never Dry					Sikadur 36 Marine Gel	Patching, (marine gel); Vertical, overhead repairs; Underwater application only; Compressive str. - 28 days ASTM D-695 - Neat 1240psi, Mortar 1130psi.

F-P - Fair to Poor

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DSS CONTRACT 23SQ.23440-4-9246
OFFSHORE STRUCTURES
EVALUATION OF SUITABILITY OF EXISTING
REPAIR MATERIALS (PHASE II)
LABORATORY TESTING PROGRAM

FINAL REPORT

Report No. 87-79-P

J.J. Deans, P.K. Mukherjee and E.J. McColm
Engineers
Concrete Technology Section/Civil Research Dept.

ABSTRACT

Phase I of the program deals with the review of existing information on concrete repair materials and has been reported in Ontario Hydro Research Division Report No. 87-78-P. This report (Phase II) includes results of limited laboratory tests carried out on nine selected repair materials. The selection was based on the availability of the materials and the generic types frequently used in the repair of concrete structures. The results are not conclusive, but provide an understanding of the relative performance of the materials under various curing conditions. No attempt was made to simulate field applications.

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DSS CONTRACT 23SQ.23440-4-9246 - OFFSHORE STRUCTURES
EVALUATION OF SUITABILITY OF EXISTING REPAIR MATERIALS (PHASE II)
LABORATORY TESTING PROGRAM

J.J. Deans, P.K. Mukherjee and E.J. McColm

1.0 INTRODUCTION

Recently, concrete has been increasingly used in offshore structures. In this application the concrete can frequently be subjected to severe exposure and loading conditions. Attention is therefore being focused on the long-term performance of the structures and the requirements for repair of potential damages. While inspection and repair techniques have advanced considerably in recent years, there is still a need for information on which to base the selection of repair materials and methods of application under different conditions.

Phase I ("Manufacturers Test Data and Literature Review") of the above program deals with the review of existing information on concrete repair materials and has been reported in Ontario Hydro Research Division Report No.87-78-P. Phase II of this program consists of a limited laboratory testing program carried out on selected materials and is described in this report. The intent is to obtain an understanding of the relative performance of the products under varying exposure conditions. No attempt was made to simulate the exposure conditions of offshore structures.

2.0 SELECTION OF REPAIR MATERIALS

Based on the technical information provided by manufacturers, nine repair materials were selected for testing. The selected materials represent a cross-section of various generic types. Materials which are claimed to exhibit the most favourable characteristics for repairing concrete were reviewed and selected for testing. Among the important features considered during this review were the availability of products, past performance and suitability for various environmental conditions. As well, products were

selected on the basis of the types of repairs that are frequently encountered, such as cracks, patching of old concrete, and bonding of fresh to hardened concrete.

Nine materials, consisting of six patching materials, two bonding agents and one injection resin, were selected for laboratory evaluation. These materials are listed below and a description, including their intended applications, is given in Table 1. The materials are identified with a code (A to I). The proprietary names are not listed due to confidentiality reasons. The product names are submitted separately.

Inorganic Based

- Modified Portland Cement Mortar: Patching,
- Acrylic Mortar: Patching,
- Fiber Grout with Styrene Butadiene Rubber (SBR): Patching,
- Styrene Butadiene Rubber (SBR): Bonding Agent,

Organic Based

- Polyester Mortar: Patching,
- Epoxy Mortar: Patching,
- Epoxy: Bonding Agent,
- Epoxy: Injection Resin,
- Modified Methacrylate (MMA) Mortar: Patching.

3.0 TEST PARAMETERS

Two series of test specimens were prepared. One series was used to test the properties of the repair materials in a simulated concrete repair and the other was used to determine the physical properties of the repair materials themselves.

3.1 Composite Specimens

Composite specimens were used to represent simulated concrete repair. The specimens were cylinders (75 mm dia. x 150 mm) and prisms (75 x 100 x 450 mm) and were composed of repair material bonded to hardened concrete. The specimens were made by either bonding two concrete sections to simulate the repair of a crack or by casting the repair materials or fresh concrete against hardened concrete to simulate patching. The actual method of specimen preparation depended on the intended application of the individual repair materials as described in Section 4.0.

The specimens were tested at various ages to determine their bond strength, flexural strength and change in ultrasonic pulse velocities under different curing conditions. All 28-day test results were compared with those of the control concrete cured at 23°C and 100% relative humidity.

3.2 Repair Material Specimens

The physical properties of the repair materials themselves were determined by testing appropriate specimens, ie, cubes (50 mm), cylinders (75 mm dia. x 150 mm) and prisms (75 x 150 x 400 mm and 25 x 25 x 125 mm). The properties investigated were compressive strength, modulus of elasticity, flexural strength, coefficient of thermal expansion, temperature rise (during initial set), density and flow characteristics.

4.0 PREPARATION AND CURING OF TEST SPECIMENS

In total 828 specimens were tested, consisting of 72 control specimens, 504 composite specimens and 252 specimens of the repair materials themselves. The number of specimens prepared for control concrete, composite and repair material for each set of tests are contained in Table 2, 3 and 4, respectively.

4.1 Control Concrete

Since a large quantity of concrete was required to carry out the test program, pre-packaged concrete was used to make all the control specimens, including the half sections for the composite specimens. A 25-MPa class concrete made with Type 10 Normal Portland cement and 16 mm maximum size aggregate was used. Kiln dried sand and stone were blended with cement and packaged in a bagging plant (King Paving and Materials Limited) to Ontario Hydro requirements. The uniformity of the bagged concrete was established in an earlier test program by Ontario Hydro.

The concrete was used as a standard for comparative tests. The premeasured bags were emptied into a 0.05 m^3 Lancaster mixer and mixed dry for 30 seconds. The required amounts of water and air-entraining admixture were added during the next 30 seconds and mixed for an additional 120 seconds. The batch was allowed to rest for 30 seconds followed by 90 seconds of mixing. The mix proportions and the physical properties of the concrete are given in Table 5. The chemical composition and physical properties of the cement are given in Table 6. The properties of the aggregates are included in Table 7. The average 28-day compressive strength of the hardened concrete was 33.4 MPa and the modulus of elasticity was 30.2 GPa, determined on cylinders (75 mm dia. x 150 mm) following appropriate ASTM standards.

4.2 Composite Specimens

The half prisms and cylinders, for the composite specimens, were cast using the control concrete. These half sections were initially cured for 21 days at 23°C and 100% relative humidity. Prior to applying the repair material the bond surface of the concrete was sandblasted to remove any laitance and to roughen the surface. The configuration and preparation of the composite specimens are shown in Figures 1 and 2.

All repair materials were conditioned at 23°C. The inorganic materials were mixed for a minimum of 5 minutes in the Lancaster mixer. The organic

materials were mixed for a minimum of 3 minutes using a Jiffler mixer. After mixing, the bonding materials were placed against the hardened concrete and vibrated into place. With the injection resin, a preset gap (1.2 mm) was prepared between two hardened concrete surfaces and the repair material injected into it. For the bonding agents, the repair material was applied to a hardened concrete surface before fresh concrete was cast against it. The hardened concrete in each application was pre-conditioned, wet or dry as described in Section 4.4.

4.3 Repair Material Specimens

The repair materials were mixed following the procedure described in Section 4.2, except that the specimens were made using the repair materials alone. The specimens were cured as described in Section 4.4.5.

4.4 Curing Conditions

Four sets of composite specimens and repair material specimens were made from each product. The control concrete was also cast in four sets. Each set of specimens was cured under one of the conditions described below:

4.4.1 23°C Wet

The repair materials were applied against a wet concrete surface then stored at 23°C and 100% relative humidity until tested.

4.4.2 23°C Dry

The repair materials were applied against a dry concrete surface then stored at 23°C and 50% relative humidity until tested.

4.4.3 38°C/23°C Wet

The repair materials were applied to a dry concrete surface at 23°C. The specimens were cured for 3 days in 23°C wet for the inorganic and 23° dry for the organic materials followed by 4 days at 38°C dry. Two specimens were tested at 7 days and the remaining specimens were cycled between 23°C wet and 38°C every 10 days. After 28 days two specimens were tested (3 cycles) and the remaining specimens were cycled between the two environments (38°C/23°C wet) every 14 days until the final test at 91 days (8 cycles). All specimens were tested at 38°C.

4.4.4 -20°C/23°C Wet

The repair materials were applied to a dry concrete surface at 23°C. The specimens were cured for 3 days in 23°C wet for the inorganic and 23° dry for the organic materials followed by 3 days at -20°C. Two specimens were tested at 7 days and the remaining specimens were cycled between 23°C wet and -20°C every 10 days. After 28 days two specimens were tested (3 cycles) and the remaining specimens were cycled between the two environments (-20°C/23° wet) every 14 days until the final test at 91 days (8 cycles). All specimens were conditioned at 23°C for 24 hours prior to testing.

The repair material specimens were cured under the same conditions as above except for the flexural test specimens. The flexural test specimens made with inorganic materials were cured at 23°C wet and the organic materials at 23°C dry. None of the flexural specimens were cured under cyclic conditions.

5.0 TESTS AND RESULTS

5.1 Composite and Control Specimens

The composite and control specimens cured at 23°C wet and 23°C dry were tested at 3, 7, 28 and 91 days. The specimens cycled in the other two conditions (namely 38°C/23°C wet and -20°/23°C wet) were tested at 7, 28 and 91 days. All results are the average of tests on two specimens.

5.1.1 Bond Strength

Composite cylinders were tested in accordance with ASTM C 882. Table 8 contains the 28-day test results including the results expressed as a percentage of the control concrete cured at 23°C wet. Appendix A contains a summary of the test results up to 91 days.

5.1.2 Flexural Strength

Composite prisms were tested in accordance with ASTM C 78. Table 9 contains the 28-day test results including the results expressed as a percentage of the control concrete cured at 23°C wet. Appendix B contains a summary of the test results up to 91 days.

5.1.3 Ultrasonic Pulse Velocity

Ultrasonic pulse velocity measurements were taken in accordance with ASTM C 597. Measurements were taken in the longitudinal direction of the composite prisms for flexural test prior to testing at 3, 28 and 91 days. Table 10 contains the 28-day test results including the results expressed as a percentage of the control concrete cured at 23°C wet. Appendix C contains a summary of the test results up to 91 days.

5.2 Repair Material Specimens

Not all the products could be tested for all the properties mentioned in this section. The materials which were tested are described below. Where possible the 28-day results were compared with those of the control concrete cured at 23°C wet.

5.2.1 Compressive Strength

Test cylinders, made with patching materials (Code: A,B,C,D,E,I) were tested in accordance with ASTM C 39. The latex-modified cementitious bonding agent (Code: G) and the epoxy injection resin (Code: H) were cast as cubes (50 mm) and tested in accordance with ASTM C 109. Table 11 contains the 28-day test

results including the results expressed as a percentage of the control concrete cured at 23°C wet. Appendix D contains a summary of the test results up to 91 days.

5.2.2 Modulus of Elasticity

Cylinders of patching materials (Code: A,B,C,D,E,I) were tested for modulus of elasticity in accordance with ASTM C 469. Table 12 contains the 28-day test results including the results expressed as a percentage of the control concrete cured at 23°C wet. Appendix E contains a summary of the test results up to 91 days.

5.2.3 Flexural Strength

The flexural strength of prisms made with patching materials (Code: A,B,C,D,E,I) was determined in accordance with ASTM C 78. A summary of the test results up to 91 days is given in Figure 3.

5.2.4 Coefficient of Thermal Expansion

The coefficient of thermal expansion of each of the repair materials was determined using prisms (25 x 25 x 125 mm). The test is relative and was carried out under three temperature ranges (a) -20 to 23°C; (b) 0 to 40°C; and (c) 23 to 100°C. The prisms were conditioned to the appropriate temperature and the length measured. The change in length at the various temperatures was used to calculate the coefficient of thermal expansion which is reported in Figure 4.

5.2.5 Temperature Rise (During Initial Set)

The temperature rise of some of the repair materials during initial setting was recorded. Two volumes (100 ml and 2,800 ml) of the materials were mixed and placed in containers. Thermocouples were placed in the materials and the temperature recorded at regular intervals up to seven hours after mixing. The results are shown in Figure 5 and 6.

5.2.6 Hardened Density and Flow Characteristics

The hardened density of the test specimens was determined following the appropriate ASTM standard. The results are summarized in Figure 7. The flow characteristics of some of the repair materials were recorded using an open ended 75 mm dia. x 150 mm cylinder. The cylinder was placed on a steel table and filled with freshly mixed repair material. The cylinder was then raised slowly and the material allowed to settle. A measurement of the diameter of the settled repair material on the table was recorded as the flow. This procedure was repeated at regular intervals until the material became unworkable. The results are summarized in Figure 8.

6.0 DISCUSSION

6.1 Composite Specimens

The composite specimens exhibited lower bond strengths than those of the control concrete. The test results were scattered, ranging from 5% to 69% of the control concrete. Generally, the test results were not affected by the curing conditions. The exception to this was the polyester composite (Product-D) cured at 23°C wet and the Acrylic Mortar (Product-B) composite cured at 38°C and -20°C. These prisms gained very low bond strengths. The cement based patching material (Product-A) showed the best results. In approximately 40% of the cases failure of the composite specimens occurred at the interface. The remaining specimens failed in the concrete or a combination of the concrete and the bonding interface.

The composite specimens generally exhibited lower flexural strengths than those of the control concrete. The results were scattered ranging from 6% to 104% of the control concrete. Most composite specimens developed their maximum strength within 3 days (Appendix B). The flexural strength of the composite specimens cured at 38°C/23°C wet generally declined after 3 days. A similar decline was also noted in almost 50% of the specimens cured at -20°C/23°C wet. Most of the composite specimens exhibited low strength under at least one of the test environments. Approximately 60% of the composite specimens failed at the interface. The remaining failures occurred mainly in the concrete.

The ultrasonic pulse velocity measurements were generally good at all ages indicating no significant change due to the exposure conditions. In some instances the ultrasonic pulse velocity measurements did not identify inadequacies in the bond between the concrete and the repair materials. This is unexpected and the reason could not be explained readily.

6.2 Repair Material Specimens

All repair materials, except the Acrylic Mortar (Product-B, Table 11), showed higher compressive strengths than those of the control concrete. The moduli of elasticity were lower than those of the control concrete, except for the Modified Portland Cement Mortar (Product-A, Table 12).

The flexural strength of the patching materials cured at 23°C ranged from 4 MPa to 24 MPa (Figure 3). The strength of the organic materials was greater than that of the inorganic materials and was up to four times greater than that of the control concrete.

The organic materials showed high coefficients of thermal expansion (Figure 4). The values varied significantly (ie, 15 to 195 x 10^{-6}/°C), depending on the type of material and filler content. The different temperature ranges significantly affected the test results for the organic materials. The temperature range of 23 to 100°C produced the largest thermal

expansion. The inorganic materials generally had similar coefficients of thermal expansion to that of the control concrete (ie, $10 \times 10^{-6}/°C$) at all temperature ranges.

During the initial set, virtually no temperature increase was observed in the inorganic materials. However, most of the organic materials showed a large temperature increase up to a maximum of about 16 °C (Figure 5). The rise in temperature was greater for the larger sample size (Figure 6).

The consistency of the repair materials after mixing at 23°C ranged from workable to flowable. Most of the materials lost their workability within a relatively short period of time (Figure 8). The organic materials lost it at a much faster rate than the inorganics. The hardened densities of some of the repair materials (Code: B,D,E) were less than 2,000 kg/m^3 (Figure 7).

7.0 CONCLUSIONS

7.1 In comparison to the control concrete, the composite specimens showed a wide range of performance variance. A summary of the test results is given in Table 13. The performance of the materials was arbitrarily classified as questionable if their bond or flexural strength was less than 50% of the control or their compressive strength was less than 80% of the control. Of the materials tested as composites, the Modified Portland Cement Mortar (Product-A), Epoxy Mortar (Product-E) and the Modified Methacrylate Mortar (Product-I) performed well under most of the testing environments, although, the latter two were questionable under 23°C wet.

7.2 The compressive strength of the organic materials is significantly higher than that of the inorganic materials under normal temperatures (23°C). The 28-day modulus of elasticity of the repair materials was generally lower than that of the control concrete. The only exception was the Modified Portland Cement Mortar (Product-A).

7.3 The coefficient of thermal expansion of the organic materials was higher than that of the inorganic materials.

7.4 Generally the organic materials showed a significantly higher temperature rise than the inorganic. The organic materials also tended to lose their workability much faster than the inorganic.

7.5 The limited test results reported here indicate that none of the materials can be used under all exposure conditions. The few which appear to have potential (see Section 7.1) for use under extreme conditions will require further evaluation. Laboratory testing is suggested, to evaluate properties such as freeze-thaw, creep, impact and abrasion. Any field evaluation should be carried out under simulated field conditions to establish their suitability.

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JJD/PKM/EJM:mao

TABLE 1

DSS CONTRACT 23SQ.23440-4-9246
REPAIR MATERIAL TYPE AND MIX PROPORTIONS

Product Identification Code	Product Type		Use	Mix Proportions			Remarks
				Organic	Inorganic		
	Organic	Inorganic		Resin to Catalyst Ratio By Weight	Latex /1/ to Solids Ratio By Weight	Water to Solids Ratio By Weight	
A	-	Modified Portland Cement	Patching	-	-	0.100	Solids include cement and aggregate.
B	-	Acrylic Mortar	Patching	-	0.072	-	Solids include cement and aggregate.
C	-	Fiber grout with Styrene Butadiene Rubber (SBR)	Patching	-	0.075	-	Solids include cement and aggregate.
D	Polyester Mortar	-	Patching	0.400	-	-	Catalyst is blended with aggregate and accelerators.
E	Epoxy Mortar	-	Patching	2.70*	-	-	*The combined resin and catalyst is mixed with aggregate at a ratio of 1.0/6.0 by weight.
F	Epoxy	-	Bonding	2.00	-	-	-
G	-	Styrene Butadiene Rubber (SBR)	Bonding	-	0.183	-	Solids include cement.
H	Epoxy	-	Injection	3.00	-	-	-
I	Modified Methacrylate	-	Patching	0.125	-	-	Catalyst is blended with aggregate and accelerators.

/1/ Latex base is either acrylic or SBR.

TABLE 2

DSS CONTRACT 23SQ.23440-4-9246

NUMBER OF CONTROL CONCRETE SPECIMENS PREPARED AND TESTED UNDER VARIOUS CURING CONDITIONS/1/

Test	Curing Conditions																Total Number of Specimens	Specimen Dimensions
	23°C Wet				23°C Dry				38°C/23°C Wet/2/				-20°C/23°C Wet/2/					
	Age (days)				Age (days)				Age (days)				Age (days)					
	3	7	28	91	3	7	28	91	3	7	28	91	3	7	28	91		
ASTM C78 Flexural Strength	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	32	Prism 75X100X400mm
ASTM C39 Compressive Strength	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	32	Cylinder 75mm dia X 150mm
ASTM C469 Modulus of Elasticity/3/	-	XX	-	-	-	XX	-	-	-	XX	-	-	-	XX	-	-	8	Cylinder 75mm dia X 150mm

/1/ Each "X" in the table represents one test specimen. Where (-) is shown, no specimens were made.
/2/ The number of cycles are described in Section 4.4 of the report.
/3/ The specimens tested at 7 days were also used for the tests at 28 and 91 days.

TABLE 3

DSS CONTRACT 23SQ.23440-4-9246

NUMBER OF COMPOSITE SPECIMENS PREPARED AND TESTED UNDER VARIOUS CURING CONDITIONS/1/

Test	Product Identification (see Table 1)	Curing Conditions												Total Number of Specimens	Specimen Dimensions
		23°C Wet				23°C Dry				38°C/23°C Wet/2/				-20°C/23°C Wet/2/					
		Age (days)				Age (days)				Age (days)				Age (days)					
		3	7	28	91	3	7	28	91	3	7	28	91	3	7	28	91		
ASTM C78 Flexural Strength	A	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	Prism 75 x 100 x 400 mm
	B	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	C	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	D	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	E	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	F	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	G	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	H	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	I	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
ASTM C882 Bond Strength	A	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	Cylinder 75 mm dia x 150 mm
	B	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	C	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	D	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	E	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	F	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	G	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	H	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	
	I	xx	xx	xx	xx	xx	xx	xx	xx	/3/	xx	xx	xx	/3/	xx	xx	xx	28	

/1/ Each "x" in the table represents one test specimen.
/2/ The number of cycles are described in Section 4.4.
/3/ Specimens were not made because the 3-day results from the 23°C Wet were used.

TABLE 4

DSS CONTRACT 23SQ.23440-4-9246
NUMBER OF REPAIR MATERIAL SPECIMENS PREPARED AND TESTED
UNDER VARIOUS CURING CONDITIONS/1/

Test	Product Identification Code (see Table 1)	Curing Conditions: 23°C Wet Age (days) 3	7	28	91	23°C Dry Age (days) 3	7	28	91	38°C/23°C Wet/2/ Age (days) 3	7	28	91	-20°C/23°C Wet/2/ Age (days) 3	7	28	91	Total Number of Specimens	Specimen Dimensions
ASTM C78 Flexural Strength	A	-	xx	xx	xx	-	-	-	-									6	Prism 75 x 100 x 400 mm
	B	-	xx	xx	xx	-	-	-	-									6	
	C	-	xx	xx	xx	-	-	-	-									6	
	D	-	-	-	-	-	xx	xx	xx									6	
	E	-	-	-	-	-	xx	xx	xx			-				-		6	
	F	-	-	-	-	-	-	-	-									0	
	G	-	-	-	-	-	-	-	-									0	
	H	-	-	-	-	-	-	-	-									0	
	I	-	-	-	-	-	xx	xx	xx									6	
ASTM C39 Compressive Strength	A	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	Cylinder 75mm dia x 150mm
	B	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	
	C	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	
	D	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	
	E	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	
	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	*Materials G&H tested as cubes 50 mm
	G*	-	xx	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-	12	
	H*	-	xx	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-	12	
	I	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	-	xx	xx	xx	24	
ASTM C469 Modulus of Elasticity	A	-	xx	/3/		-	xx	/3/		-	xx	/3/		-	xx	/3/		8	Cylinder 75mm dia x 150mm
	B	-	xx			-	xx			-	xx			-	xx			8	
	C	-	xx			-	xx			-	xx			-	xx			8	
	D	-	xx			-	xx			-	xx			-	xx			8	
	E	-	xx			-	xx			-	xx			-	xx			8	
	F	-	-			-	-			-	-			-	-			0	
	G	-	-			-	-			-	-			-	-			0	
	H	-	-			-	-			-	-			-	-			0	
	I	-	xx			-	xx			-	xx			-	xx			8	

/1/ Each "x" in the table represents one test specimen. Where (-) is shown no specimens were made.
/2/ The number of cycles are described in Section 4.4.
/3/ The specimens tested at 7 days were also used for the tests at 28 and 91 days.

TABLE 5

DSS CONTRACT 23SQ.23440-4-9246
MIX PROPORTION AND PROPERTIES OF PRE-PACKAGED CONTROL CONCRETE
(LAB SERIAL NO: 13736-1 TO 39)

Materials	Mix Proportions kg		Properties of Fresh Concrete			Compressive Strength Cylinders 75 mm dia. x 150 mm MPa		Modulus of Elasticity GPa
	per m^3	per batch/1/	Avg Slump mm	Avg Air Content %	Avg Density kg/m^3	7-day	28-day	28-day
Cement: Type 10	351	14.5						
Fine Aggregate: Sand	790	33	145	6.2	2295	26.8	33.4	30.2
Coarse Aggregate: 16 mm Stone	1054	45						
Water	200	8.25						
Air-entraining Admixture: Airex	145 ml	6 ml						
Gross Water/Cement Ratio	0.57							

/1/ Thirty-nine batches were made between the period March 17 and July 8, 1986. The specimens were prepared and cured as described in Section 4.0.

distribution:

TABLE 6

PHYSICAL AND CHEMICAL PROPERTIES OF CEMENT

Ontario Hydro
research division

91318 new 82-02

cement test report

project: DSS Contract 23SQ-23440-4-9246

C.L. no: 70189 sample date: Tested 18/03/86

manufacturer: St. Marys Cement Company

type: Type 10 silo no. –

mill: St. Marys

source: Cement used in pre-packaged concrete

weigh bill no. – trailer no. –

chemical analysis		%
loss on ignition	LOI	1.90
silicon dioxide	SiO_2	19.78
aluminum oxide	Al_2O_3	4.19
ferric oxide	Fe_2O_3	3.05
calcium oxide	CaO	61.11
magnesium oxide	MgO	4.33
potassium oxide	K_2O	1.02
sodium oxide	Na_2O	–
sulphur trioxide	SO_3	3.86
titanium dioxide	TiO_2	–
phosphorous pentoxide	P_2O_5	–
insoluble residue		
	total	
total alkalies	(as Na_2O)	
calculated compound composition		%
tricalcium silicate	C_3S	54.9
dicalcium silicate	C_2S	15.4
tricalcium aluminate	C_3A	5.95
tetracalcium alumino-ferrite	C_4AF	9.27
tetracalcium alumino-ferrite plus twice tricalcium aluminate		–

physical properties		result
pass 75 µm sieve (%)		96.3
pass 45 µm sieve (%)		–
Blaine air perm (m^2/kg)		385
autoclave soundness expansion (%)		0.269
heat of hydration – 7 day (kJ/kg)		–
time of set	initial (min)	146
(vicat method)	final (min)	245
false set – 11 min pen	@ 23°C	41
	@ 10°C	6
compressive strength (50 mm cubes) (MPa)	1 day	–
	3 day	20.7
	7 day	23.8
	28 day	30.8
	91 day	–
sulphate expansion (%)		–
reflectivity		–

remarks:

Physical tests conducted by Ontario Hydro
Chemical analysis conducted by St. Marys Cement Company

approved: submitted:

job no.	file no.	date:	report no.
	- 15 -		87-79

26550 (front)
rev 78-07

research division

concrete aggregate test report

project: Repair Material Program		date: March 1986	
aggregate: Pre-Packaged Concrete Aggregates		file no: 842.28	report no: 87-79-P
submitted by: Lab	quantity:	charge to: 42-506	
source: Oak Park Pit		aggregate no's: S-7507 (Sand)	
pit: Nelson Aggregate		S-7508 (16 mm stone)	

	sieve size											
mm	40	28	20	14	10	5	2.5	1.25	0.63	.315	160*	fm
inches	1 1/2	1	3/4	1/2	3/8	no. 4	8	16	30	50	100	
combined % passing												
% retained: S-7507						0	3.6	10.0	26.7	40.0	18.1	2.4
% retained : S-7508			0	5.7	28.2	66.1						

	relative density			absorp %	organic no	pass 80 um %	soundness 5 cycle loss %	petro number (PN)	attrition	
	oven dry	saturated dry	apparent						wear %	grading
fine aggregate	2.66	2.68	2.73	0.95	neg**	-	10.3**	-		
coarse aggregate	2.67	2.70	2.75	1.12	-	-	-	115**		

*Pass 100 or (0.160 mm) = 1.6%
**Data provided by the supplier (Independent commercial testing lab data)

TABLE 7

DSS CONTRACT 23SQ-23440-4-9246
Concrete Aggregate
Test Data

approved by | submitted by

TABLE 8

DSS CONTRACT 23SQ.23440-4-9246
BOND STRENGTH OF COMPOSITE CYLINDERS (75 mm dia X 150 mm)

TESTED IN ACCORDANCE WITH ASTM C882

Product Identification Code (See Table 1)	28-Day Bond Strength (MPa) and Failure Modes/1/ Cured Under Various Conditions				28-Day Bond Strength Expressed as a % of Control*			
	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/2/	-20°C/23°C Wet (3 cycles)/3/	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/2/	-20°C/23°C Wet (3 cycles)/3/
Control Concrete	33.4*	26.6	36.1	30.6	100*	80	108	92
A	23.0 (c,b,r)	19.6 (c,b,r)	22.7 (b)	21.6 (b,r)	69	59	68	65
B	15.2 (b,r)	19.5 (b,r)	8.2 (b)	9.3 (b)	46	58	25	28
C	21.7 (c,b)	18.2 (c,b)	20.1 (c,b)	22.0 (c,b)	65	54	60	66
D	1.5 (b)	18.5 (c,b)	17.5 (b)	13.9 (c,b)	5	55	52	42
E	20.9 (b)	20.3 (c)	18.1 (b)	20.1 (c,b)	63	61	54	60
F	13.8 (c,b)	14.1 (c)	17.3 (c,b)	15.1 (c,b,r)	41	42	52	45
G	15.2 (c)	13.2 (c)	18.8 (r)	14.4 (c,r)	46	40	56	43
H	15.7 (b)	14.4 (c)	10.4 (b)	13.8 (c)	47	43	31	41
I	17.6 (b)	18.9 (c)	19.0 (b)	18.3 (c)	53	57	57	55

* Control: All tests have been compared to the control concrete cured at 23°C, 100% rh

/1/ Failure Modes of Composite Specimens: c - Concrete
b - Adhesive
r - In Repair Material

/2/ Tested at 38°C
/3/ Tested at 23°C

TABLE 9

DSS CONTRACT 23SQ.23440-4-9246
FLEXURAL STRENGTH OF COMPOSITE PRISMS (75X100X400 mm)

TESTED IN ACCORDANCE WITH ASTM C78

Product Identification Code (See Table 1)	28-Day Flexural Strength (MPa) and Failure Modes/1/ Cured Under Various Conditions				28-Day Flexural Strength Expressed as a % of Control*			
	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/2/	-20°C/23°C Wet (3 cycles)/3/	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/2/	-20°C/23°C Wet (3 cycles)/3/
Control Concrete	4.8*	3.6	3.3	4.7	100*	75	69	98
A	4.9 (b)	2.9 (c,b)	2.5 (b)	3.6 (b)	102	60	52	75
B	4.7 (b,r)	3.2 (c)	0.8 (b)	2.3 (b)	98	67	17	48
C	5.0 (c,b)	1.4 (c,b)	1.8 (c,b)	4.2 (c,b)	104	29	38	88
D	0.3 (b)	1.5 (c,b)	0.8 (b)	1.4 (c,b)	6	31	17	29
E	2.1 (b)	3.8 (c)	3.9 (c,b)	4.4 (c)	44	79	81	92
F	2.2 (b)	1.9 (c,b)	2.2 (b)	2.9 (b)	46	40	46	60
G	5.0 (c)	3.4 (c)	1.9 (b)	2.3 (b)	104	71	40	48
H	0.6 (b)	4.5 (c)	2.8 (c,b)	2.7 (c,b)	13	94	58	56
I	2.1 (b)	3.2 (c)	2.9 (b)	0.3 (b)	44	67	60	6

* Control: All tests have been compared to the control concrete cured at 23°C, 100% rh

/1/ Failure Modes of Composite Specimens: c - Concrete
b - Adhesive
r - In Repair Material

/2/ Tested at 38°C
/3/ Tested at 23°C

TABLE 10

DSS CONTRACT 23SQ.23440-4-9246

ULTRASONIC PULSE VELOCITY MEASUREMENTS THROUGH COMPOSITE PRISMS (75X100X400 mm)

TESTED IN ACCORDANCE WITH ASTM C597

Product Identification Code (see Table 1)	28-Day Ultrasonic Pulse Velocity (m/s) Measurements Cured Under Various Conditions				28-Day Ultrasonic Pulse Velocity Measurements Expressed as a % of Control*			
	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/
Control Concrete	4670*	4370	4600	4520	100*	94	99	97
A	4760	4450	4570	4670	102	95	98	100
B	4400	4060	4000	4150	94	87	86	89
C	4520	4260	4400	4470	97	91	94	96
D	3780	3630	3630	3730	81	78	78	80
E	3930	3760	3500	3600	84	81	75	77
F	4730	4260	4520	4570	101	91	97	98
G	4780	4320	4550	4600	102	93	97	99
H	4780	4300	4570	4600	102	92	98	99
I	4020	3910	3970	4000	86	84	85	86

* Control: All tests have been compared to the control concrete cured at 23°C, 100% rh

/1/ Tested at 38°C
/2/ Tested at 23°C

TABLE 11

DSS CONTRACT 23SQ.23440-4-9246
COMPRESSIVE STRENGTH OF REPAIR MATERIAL CYLINDERS (75 mm dia X 150 mm)

TESTED IN ACCORDANCE WITH ASTM C39

Product Identification Code (See Table 1)	28-Day Compressive Strength (MPa) Cured Under Various Conditions				28-Day Compressive Strength Expressed as a % of Control*			
	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/
Control Concrete	33.4*	26.6	36.1	30.6	100*	80	108	92
A	43.4	47.9	44.7	45.8	130	143	134	137
B	23.0	32.6	31.4	20.7	69	98	94	62
C	48.0	50.5	49.0	45.1	144	151	147	135
D	69.4	70.5	61.9	76.0	208	211	185	228
E	72.1	72.7	51.1	77.1	216	218	153	231
F/3/	-	-	-	-	-	-	-	-
G/4/	65.6	65.9	-	-	196	197	-	-
H/4/	64.8	64.9	-	-	194	194	-	-
I	75.4	73.8	61.6	60.3	226	221	184	181

* Control: All tests have been compared to the control concrete cured at 23°C, 100% rh

(-) No tests carried out
/1/ Tested at 38°C
/2/ Tested at 23°C
/3/ Product was not tested because standard test specimens could not be made from this type of material
/4/ Compressive strength tests were conducted on 50 mm cubes in accordance with ASTM C109

TABLE 12

DSS CONTRACT 23SQ.23440-4-9246
MODULUS OF ELASTICITY OF REPAIR MATERIAL CYLINDERS (75 mm dia X 150 mm)

TESTED IN ACCORDANCE WITH ASTM C469

Product Identification Code (see Table 1)	28-Day Modulus of Elasticity (GPa) Cured Under Various Conditions				28-Day Modulus of Elasticity Expressed as a % of Control*			
	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/	23°C Wet	23°C Dry	38°C/23°C Wet (3 cycles)/1/	-20°C/23°C Wet (3 cycles)/2/
Control Concrete	30.2*	26.0	29.4	27.8	100*	86	97	92
A	35.0	29.0	39.2	28.8	116	96	130	95
B	23.0	15.2	15.6	16.9	76	50	52	56
C	22.5	19.6	22.7	22.5	75	65	75	75
D	9.1	9.1	7.1	8.6	30	30	24	28
E	13.0	11.0	8.9	15.0	43	36	29	50
F/3/	-	-	-	-	-	-	-	-
G/3/	-	-	-	-	-	-	-	-
H/3/	-	-	-	-	-	-	-	-
I	22.4	26.0	21.2	22.7	74	86	70	75

* Control: All tests have been compared to the control concrete cured at 23°C, 100% rh

/1/ Tested at 38°C
/2/ Tested at 23°C
/3/ Product was not tested because standard test specimens could not be made from this type of material

TABLE 13

DSS CONTRACT 23SQ.23440-4-9246

SUMMARY OF THE PERFORMANCE/1/OF COMPOSITE AND REPAIR MATERIAL SPECIMENS CURED UNDER VARIOUS CONDITIONS

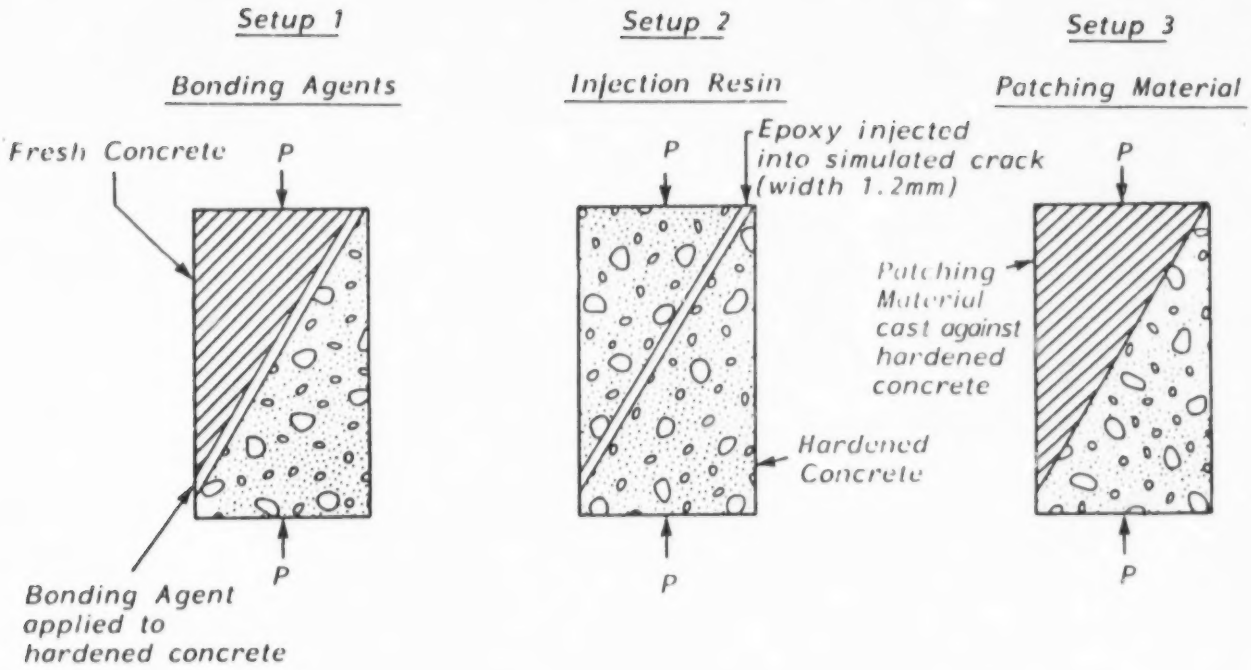
Product Identification Code (see Table 1)	28-Day BOND STRENGTH				28-Day FLEXURAL STRENGTH				28-Day COMPRESSIVE STRENGTH			
	23°C Wet	23°C Dry	38°C/23°C Wet 3 cyls/2/	-20°C/23°C Wet 3 cyls/3/	23°C Wet	23°C Dry	38°C/23°C Wet 3 cyls/2/	-20°C/23°C Wet 3 cyls/3/	23°C Wet	23°C Dry	38°C/23°C Wet 3 cyls/2/	-20°C/23°C Wet 3 cyls/3/
A	P	P	P	P	P	P	P	P	P	P	P	P
B	Q	P	Q	Q	P	P	Q	Q	Q	P	P	Q
C	P	P	P	P	P	Q	Q	P	P	P	P	P
D	Q	P	P	Q	Q	Q	Q	Q	P	P	P	P
E	P	P	P	P	Q	P	P	P	P	P	P	P
F	Q	Q	P	Q	Q	Q	Q	P	-	-	-	-
G	Q	Q	P	Q	P	P	Q	Q	P	P	-	-
H	Q	Q	Q	Q	Q	P	P	P	P	P	-	-
I	P	P	P	P	Q	P	P	Q	P	P	P	P

Blank (-) indicates product not tested

/1/ Materials were questionable (identified as 'Q') if their bond or flexural strength was less than 50% of the control or their compressive strength was less than 80% of the control. The remaining materials are identified as 'P'.

/2/ Tested at 38°C

/3/ Tested at 23°C



Notes: (1) All concrete surfaces were sandblasted prior to applying repair material

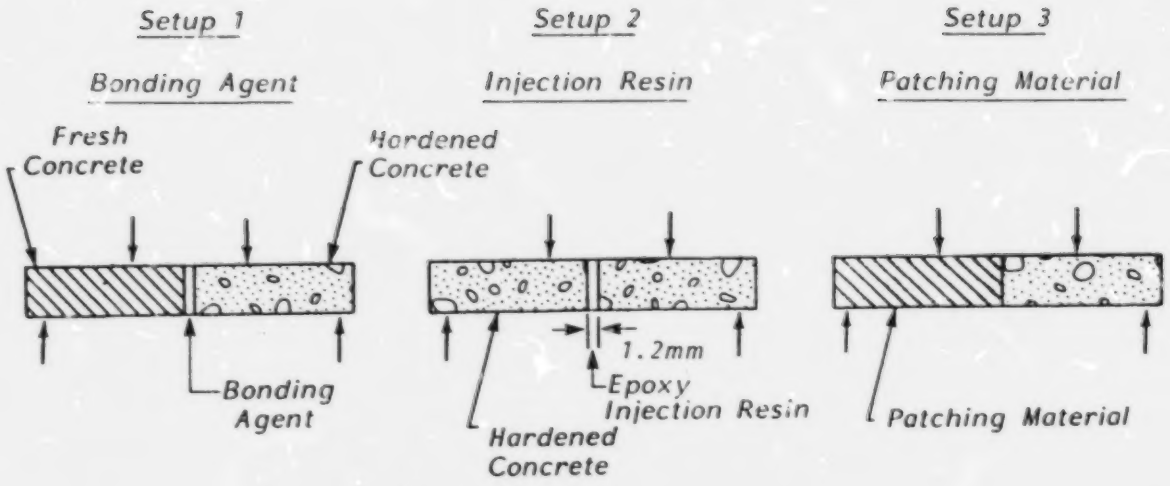
(2) Repair materials were applied in accordance with manufacturer's recommendations

(3) Specimens were tested in accordance with ASTM C882

(4) Cylinder dimensions 75 mm dia x 150 mm

FIGURE 1

DSS CONTRACT 23SQ.23440-4-9246
PREPARATION OF COMPOSITE SPECIMENS
FOR BOND STRENGTH TEST



Notes:
(1) All concrete surfaces were sandblasted prior to applying repair material

(2) Repair materials were applied in accordance with manufacturer's recommendations

(3) Ultrasonic pulse measurements were taken through the length of the specimen and compared with control specimens

(4) Specimens were tested in flexure in accordance with ASTM C78

(5) The failure load and failure mode were recorded

(6) Prism dimensions 75 x 100 x 400 mm

FIGURE 2

DSS CONTRACT 23SQ.23440-4-9246
PREPARATION OF COMPOSITE SPECIMENS FOR FLEXURAL STRENGTH TEST AND ULTRASONIC PULSE VELOCITY MEASUREMENTS

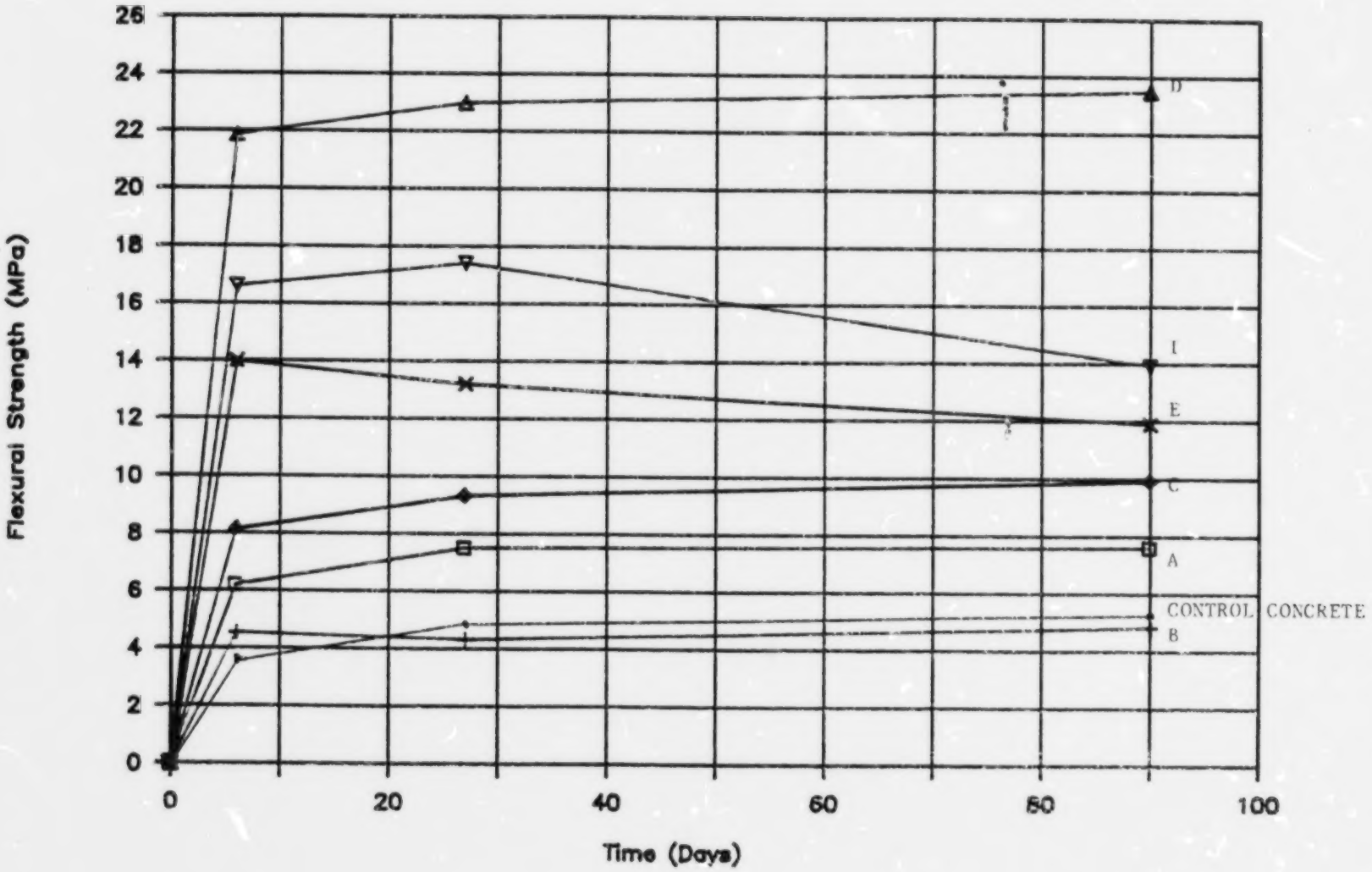


FIGURE 3

FLEXURAL STRENGTH OF REPAIR MATERIAL SPECIMENS (75 x 100 x 400 mm)
PRODUCTS: A,B,C,D,E,I

NOTE: Products F,G, and H were not tested because standard specimens could not be made from these materials.

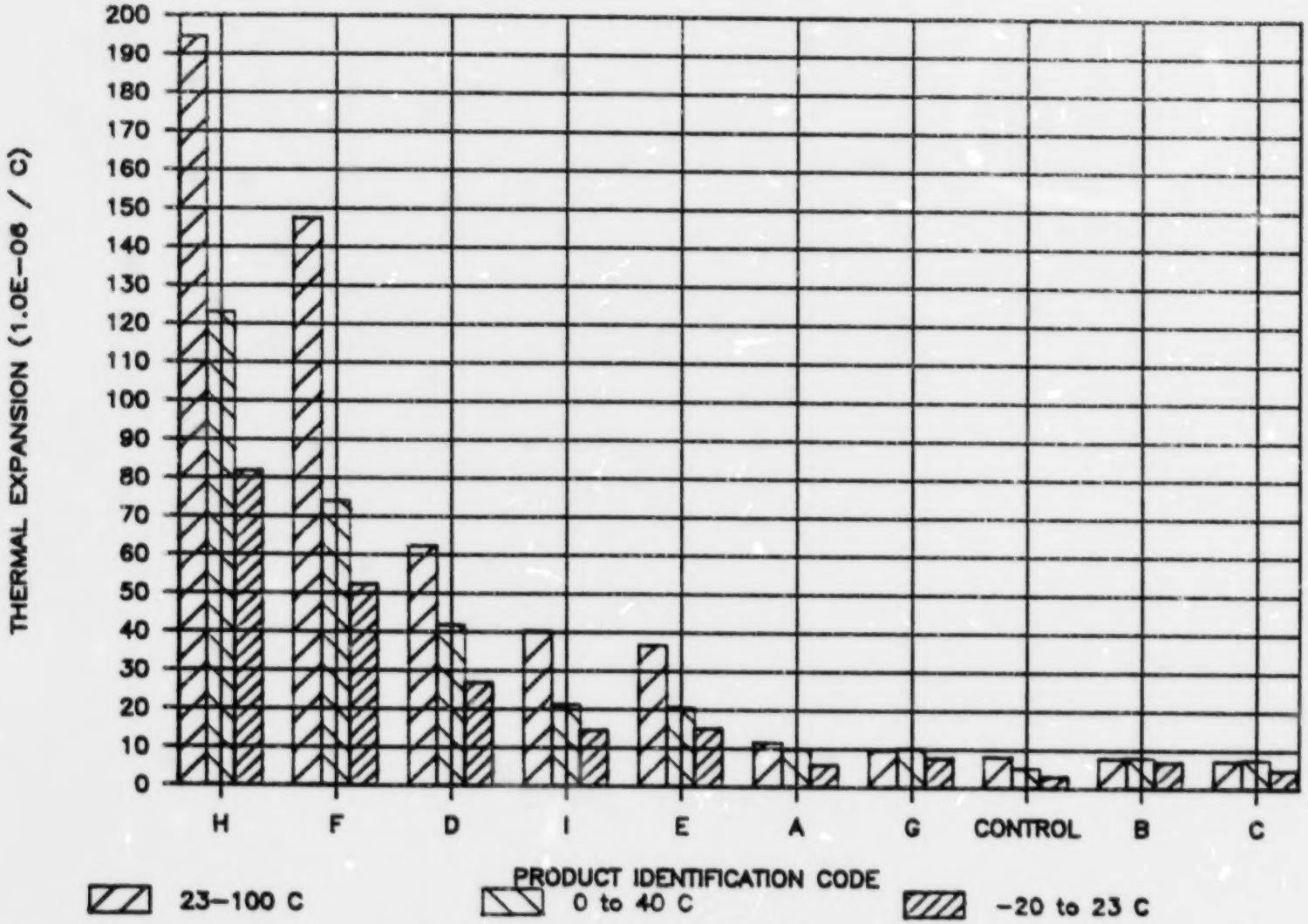


FIGURE 4

COEFFICIENT OF THERMAL EXPANSION OF REPAIR MATERIALS (prism 25 x 25 x 125 mm)

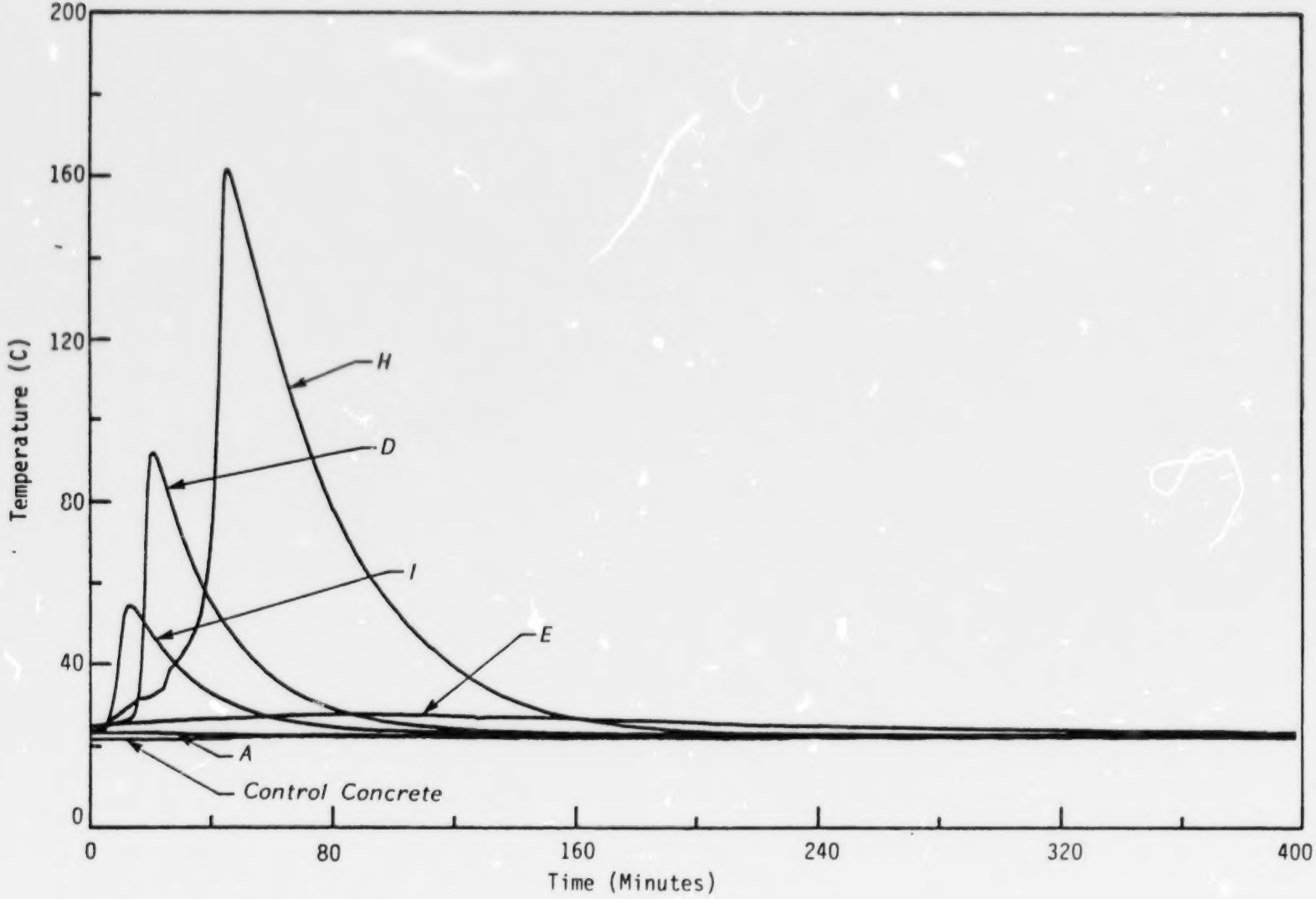


FIGURE 5
TEMPERATURE RISE IN REPAIR MATERIALS
PRODUCT A,D,E,I,H
SAMPLE SIZE: 100 ml

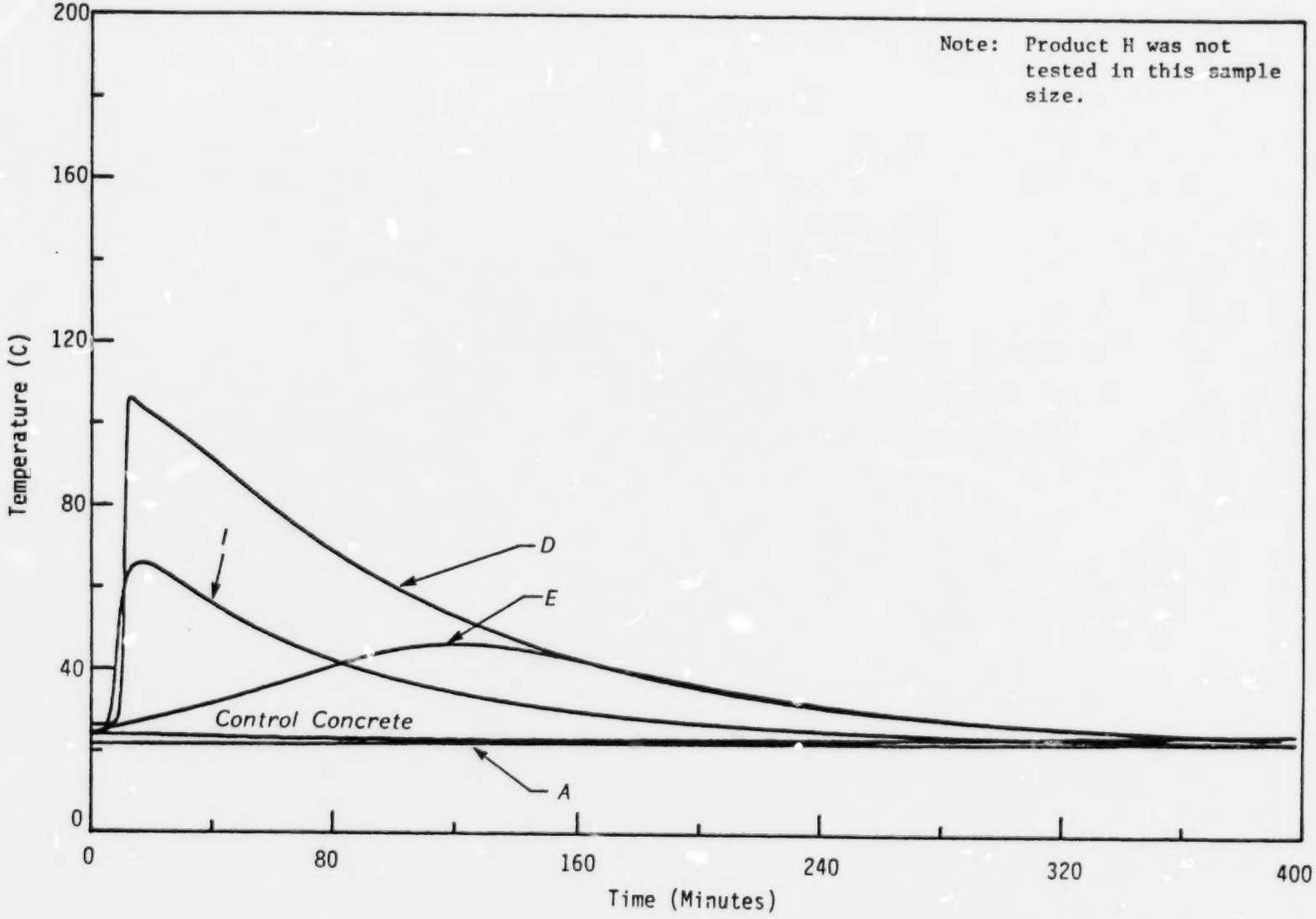


FIGURE 6
TEMPERATURE RISE IN REPAIR MATERIALS
PRODUCT A,D,E,I
SAMPLE SIZE: 2800 ml

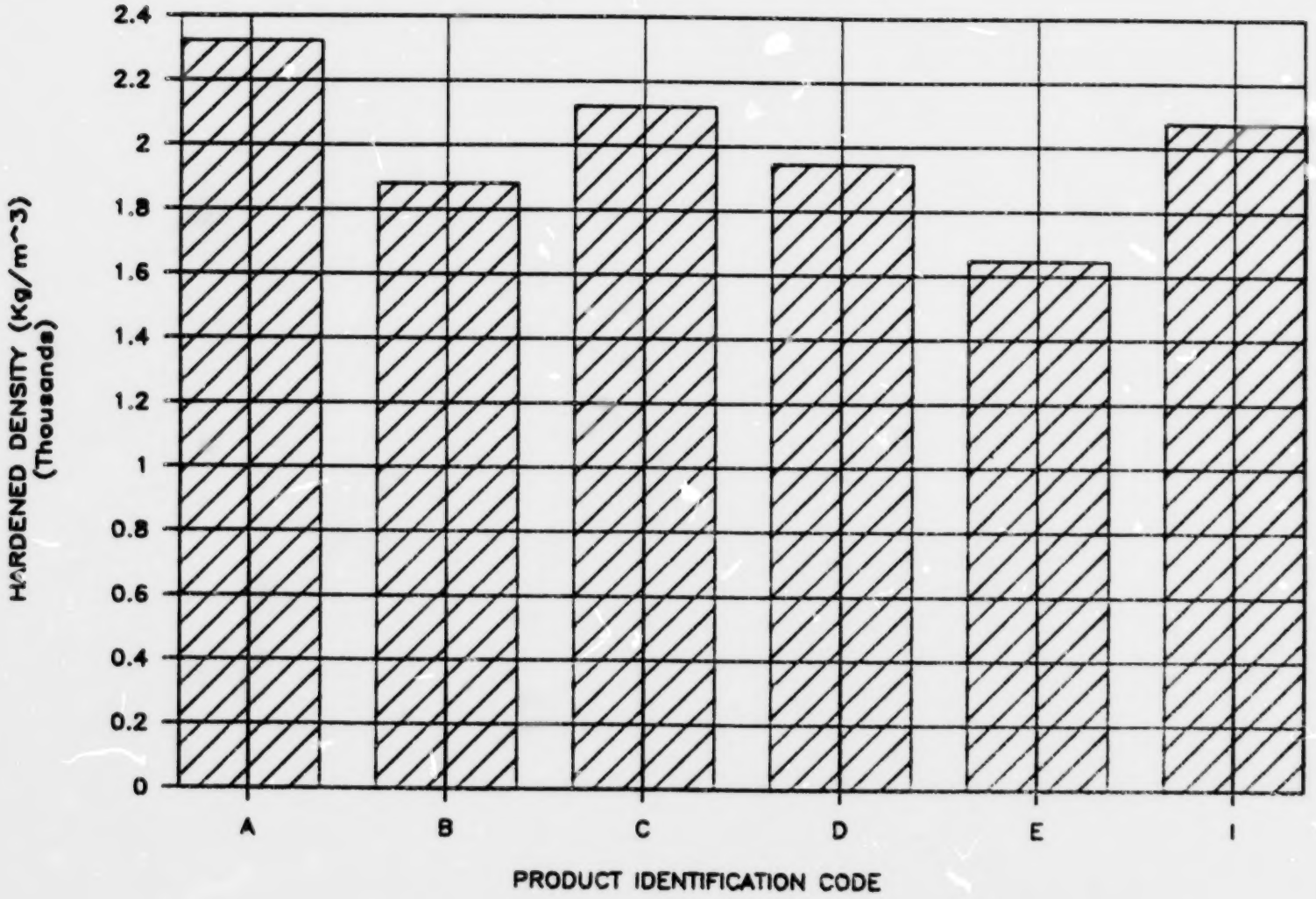


FIGURE 7

HARDENED DENSITY OF REPAIR MATERIALS

NOTE: Product F,G, and H were not tested.

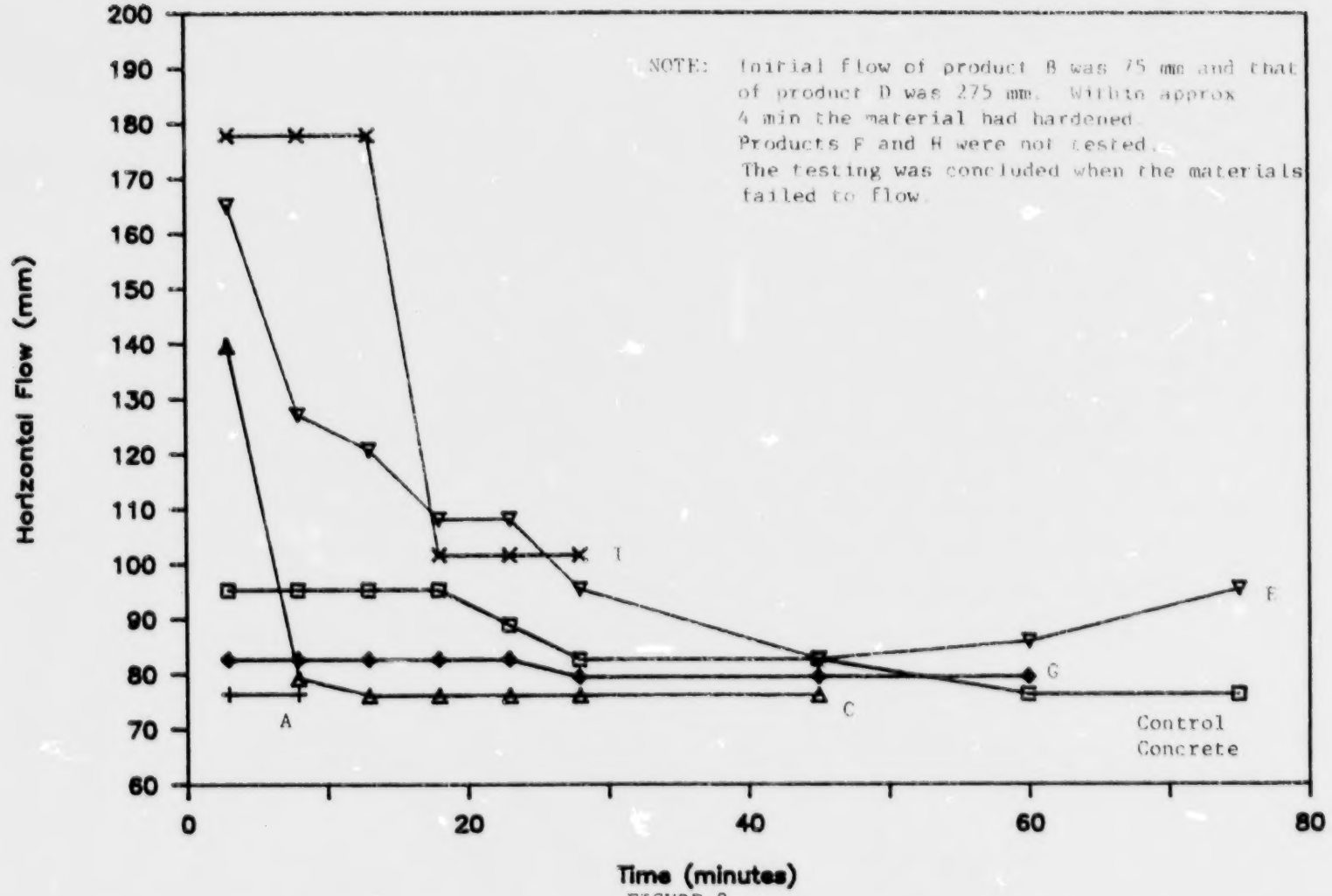


FIGURE 8

FLOW CHARACTERISTICS OF REPAIR MATERIALS

APPENDIX A

BOND STRENGTH OF COMPOSITE SPECIMENS

ASTM C882

APPENDIX A

BOND STRENGTH OF COMPOSITE SPECIMENS

ASTM C882

This appendix contains graphical representations of the bond strength data for composite specimens cured under various conditions. The specimens were tested at 3, 7, 28 and 91 days in accordance with ASTM C882 as reported in Section 5.1.1. Descriptions of the curing conditions are given in Section 4.4

Product	Curing Conditions	Figure
A,B,C,D,E	23°C Wet	A1
F,G,H,I	23°C Wet	A2
A,B,C,D,E	23°C Dry	A3
F,G,H,I	23°C Dry	A4
A,B,C,D,E	38°C/23°C Wet*	A5
F,G,H,I	38°C/23°C Wet*	A6
A,B,C,D,E	-20°C/23°C Wet**	A7
F,G,H,I	-20°C/23°C Wet**	A8

*The specimens were cycled between 23°C wet and 38°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

**The specimens were cycled between 23°C wet and -20°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

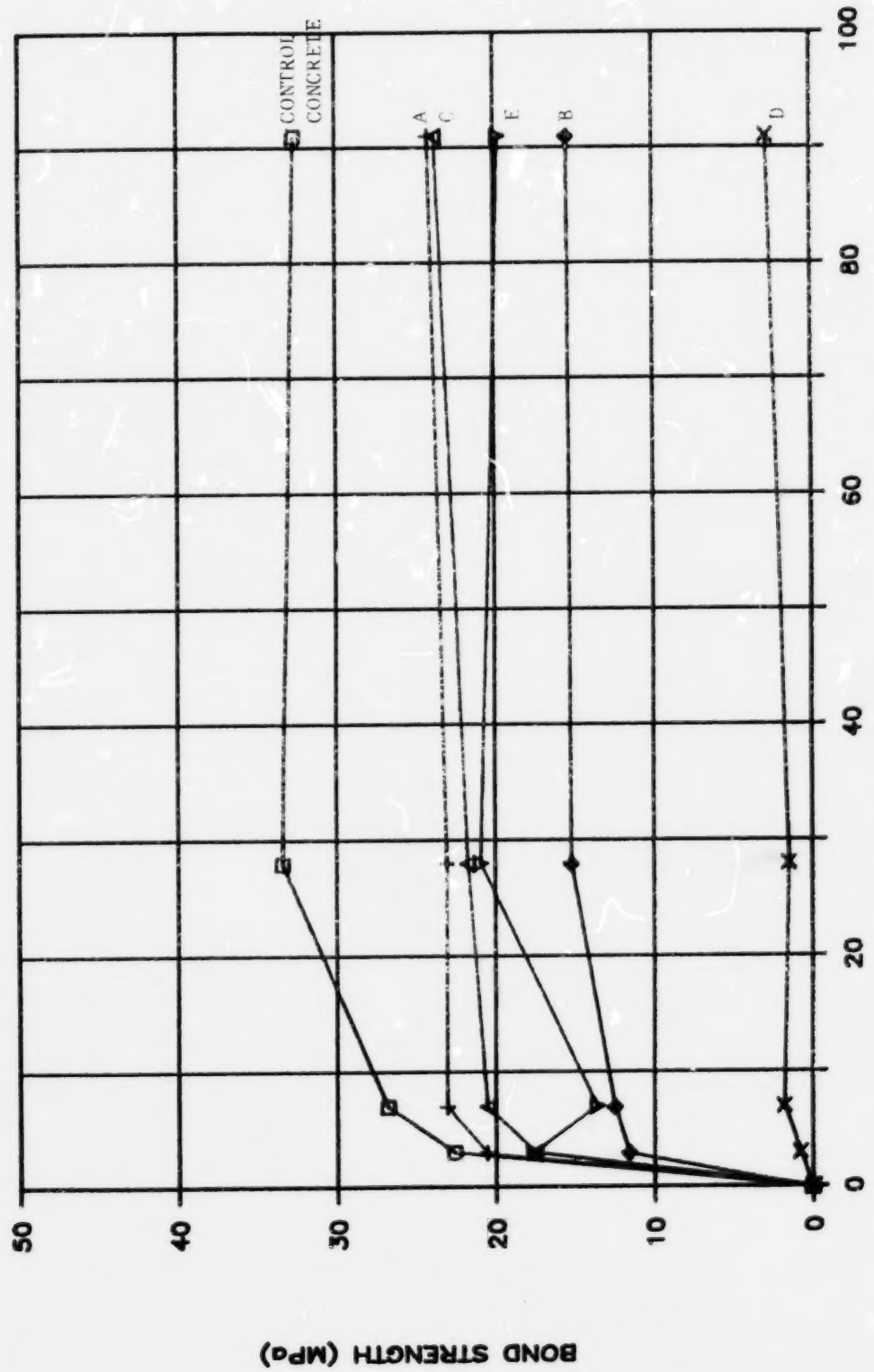


FIGURE A1

BOND STRENGTH OF COMPOSITE SPECIMENS: 23°C WET

PRODUCT: A,B,C,D,E

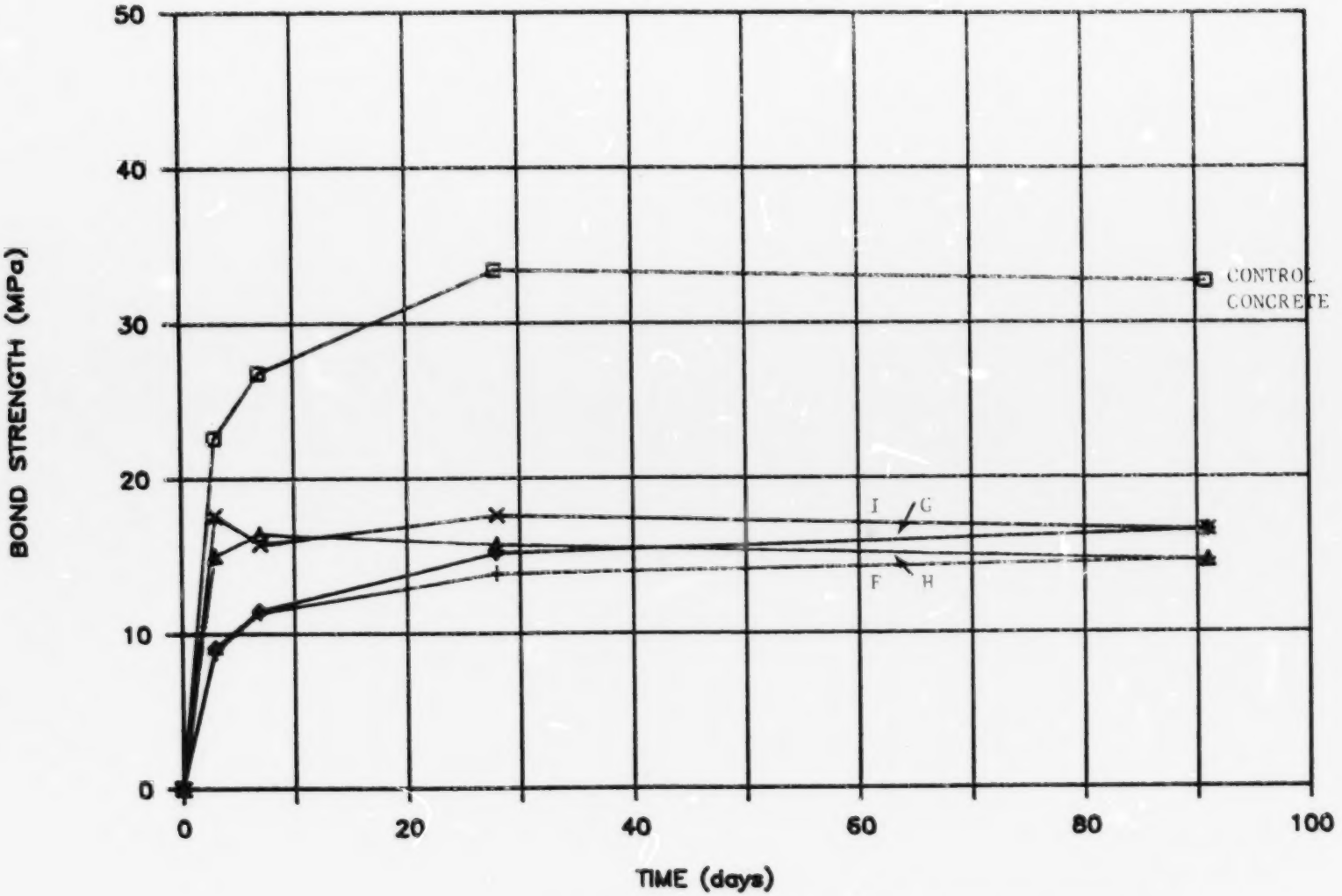


FIGURE A2

BOND STRENGTH OF COMPOSITE SPECIMENS: 23°C WET

PRODUCT: F,G,H,I

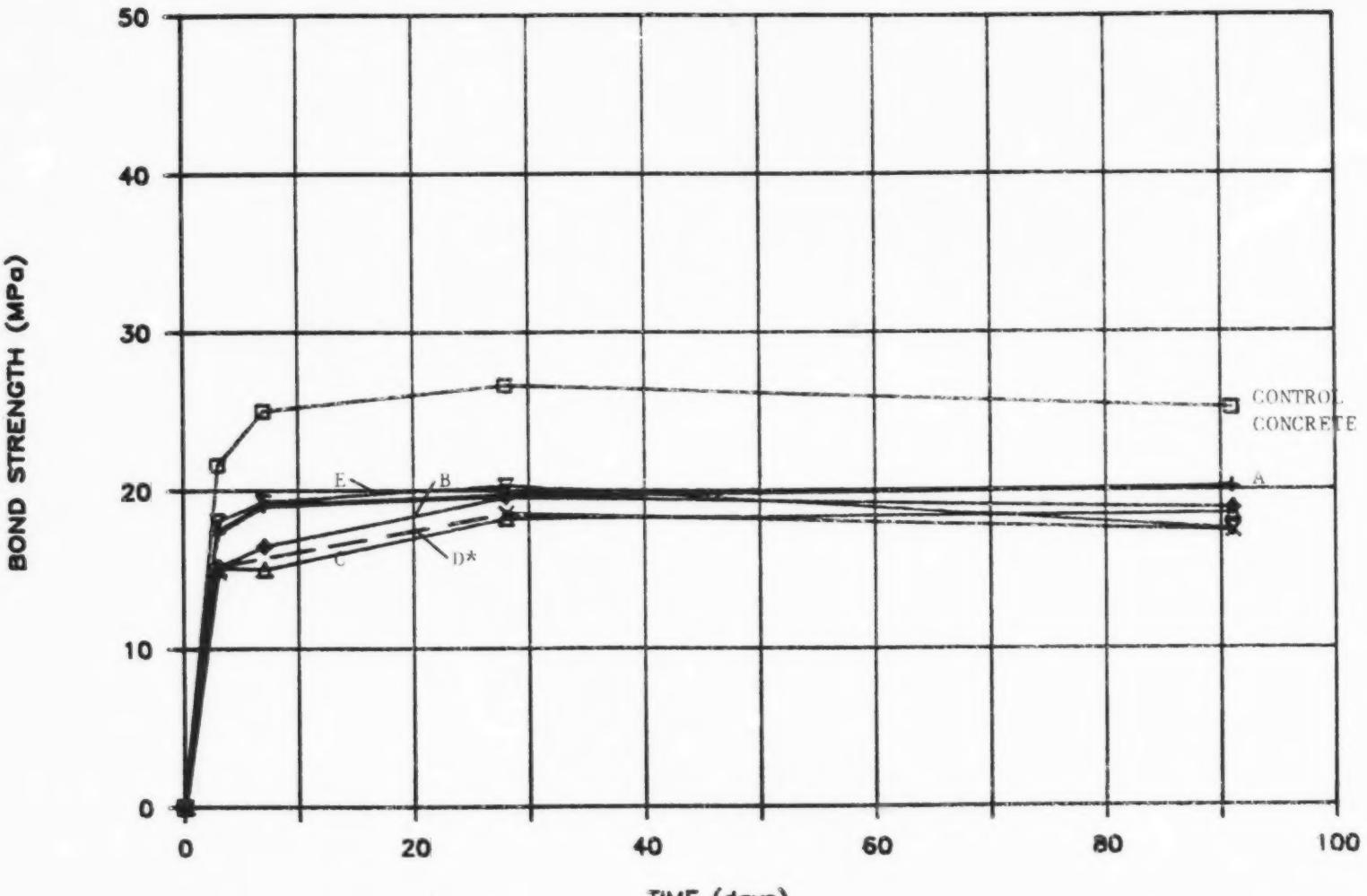


FIGURE A3

BOND STRENGTH OF COMPOSITE SPECIMENS: 23°C DRY
PRODUCT: A,B,C,D,E

*7-day test results unreliable and have not been included.

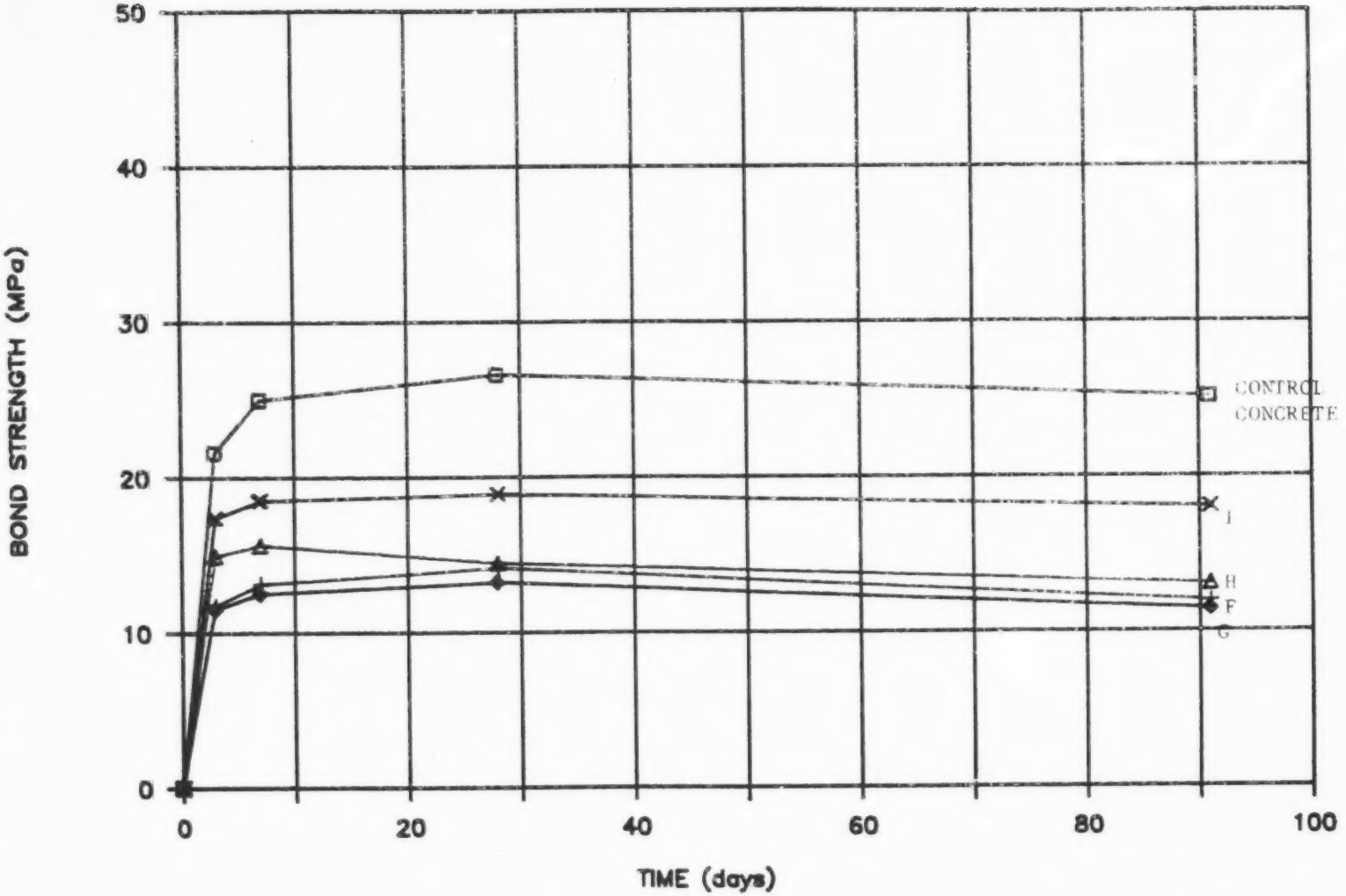


FIGURE A4
BOND STRENGTH OF COMPOSITE SPECIMENS: 23°C DRY
PRODUCT: F,G,H,I

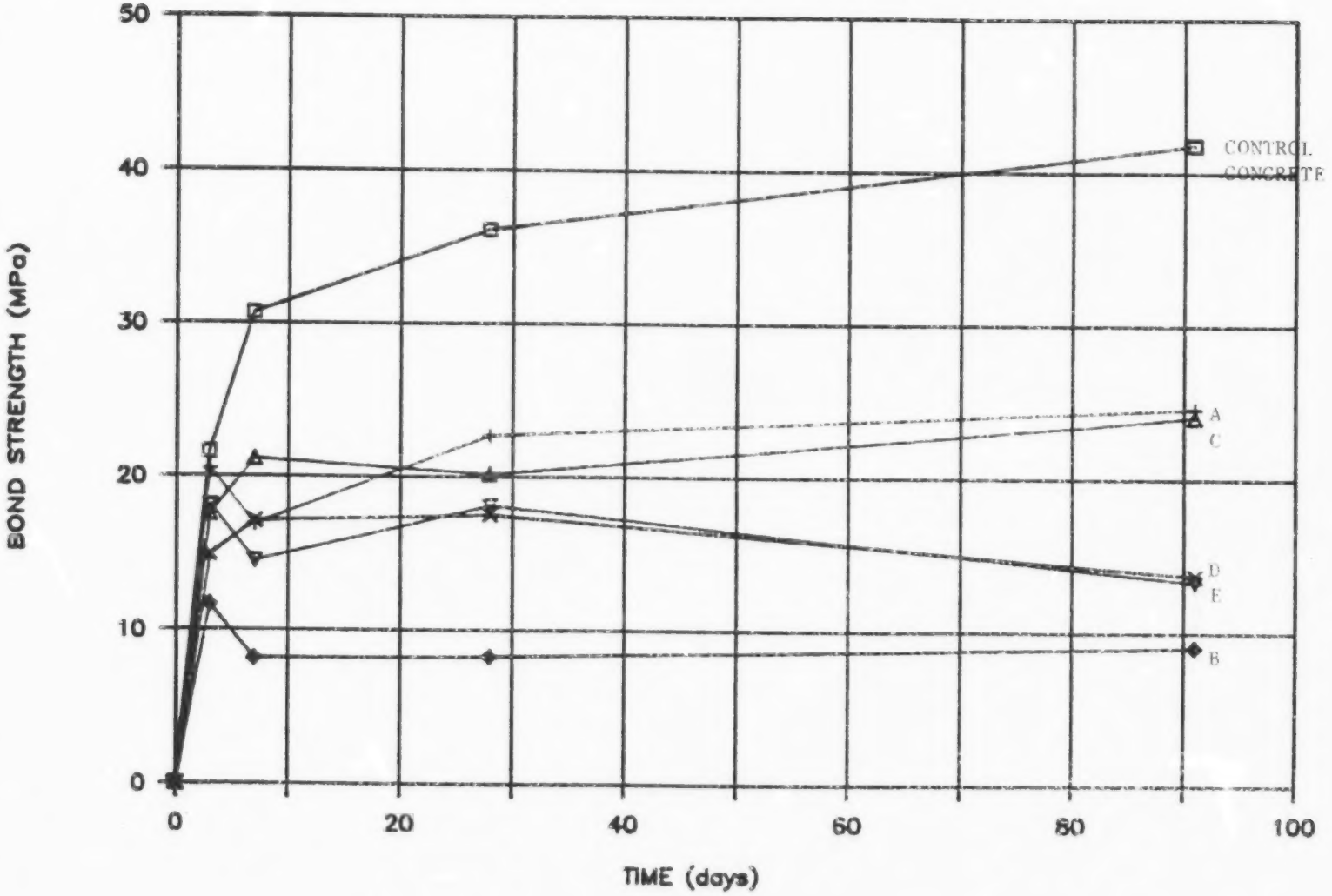


FIGURE A5
BOND STRENGTH OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: A,B,C,D,E

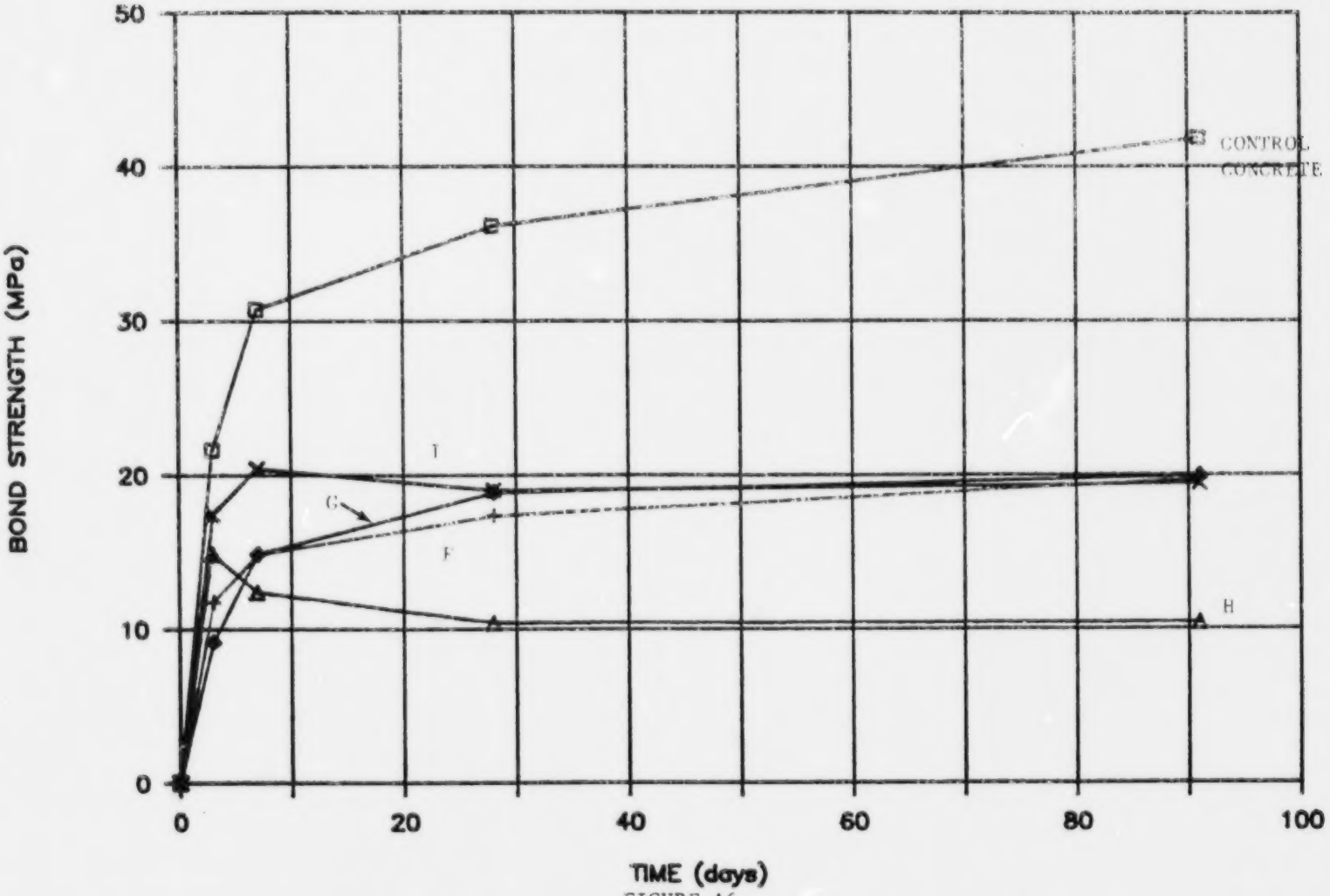


FIGURE A6
BOND STRENGTH OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: F,G,H,I

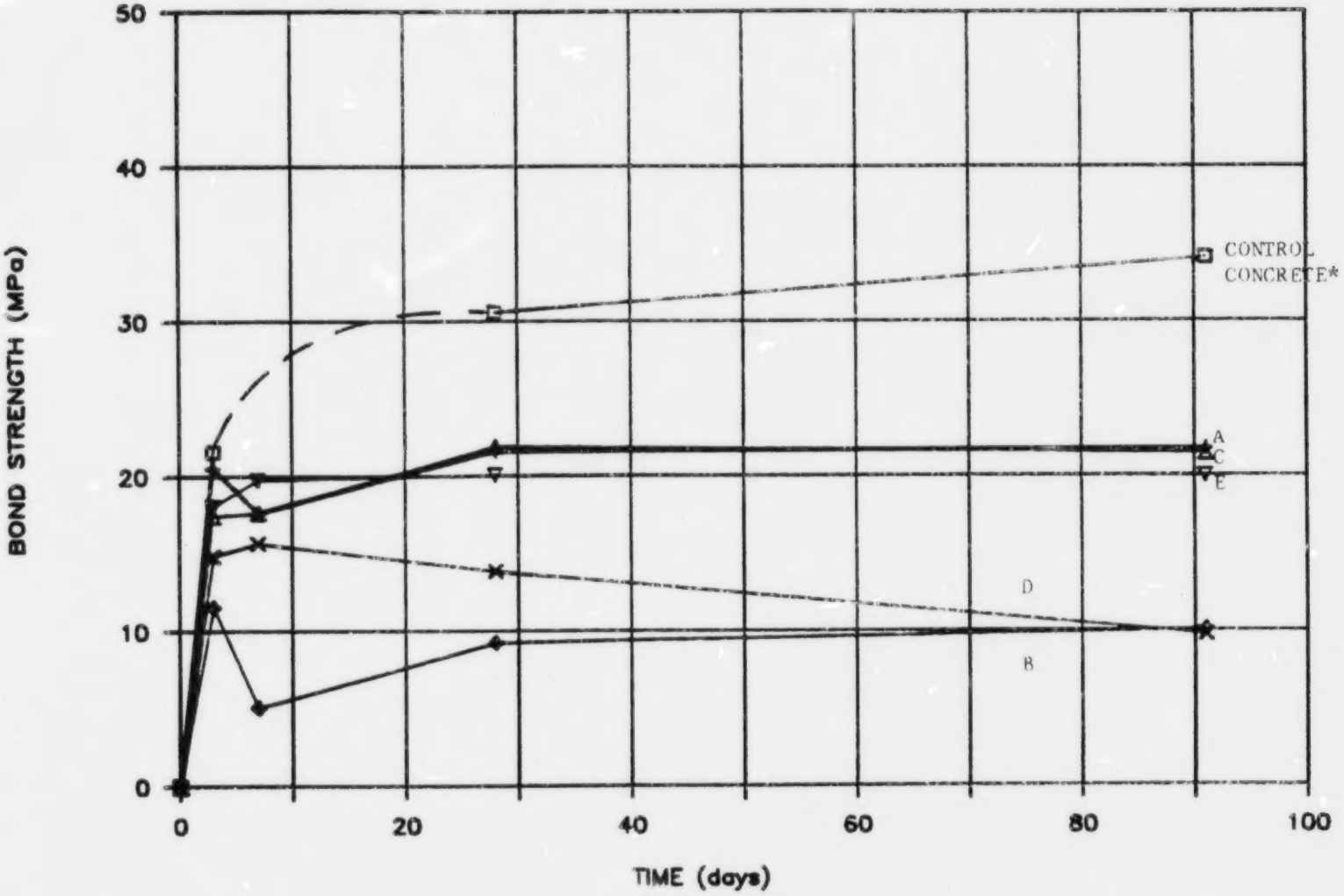


FIGURE A7
BOND STRENGTH OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: A,B,C,D,E

*7-day test results unreliable and have not been included

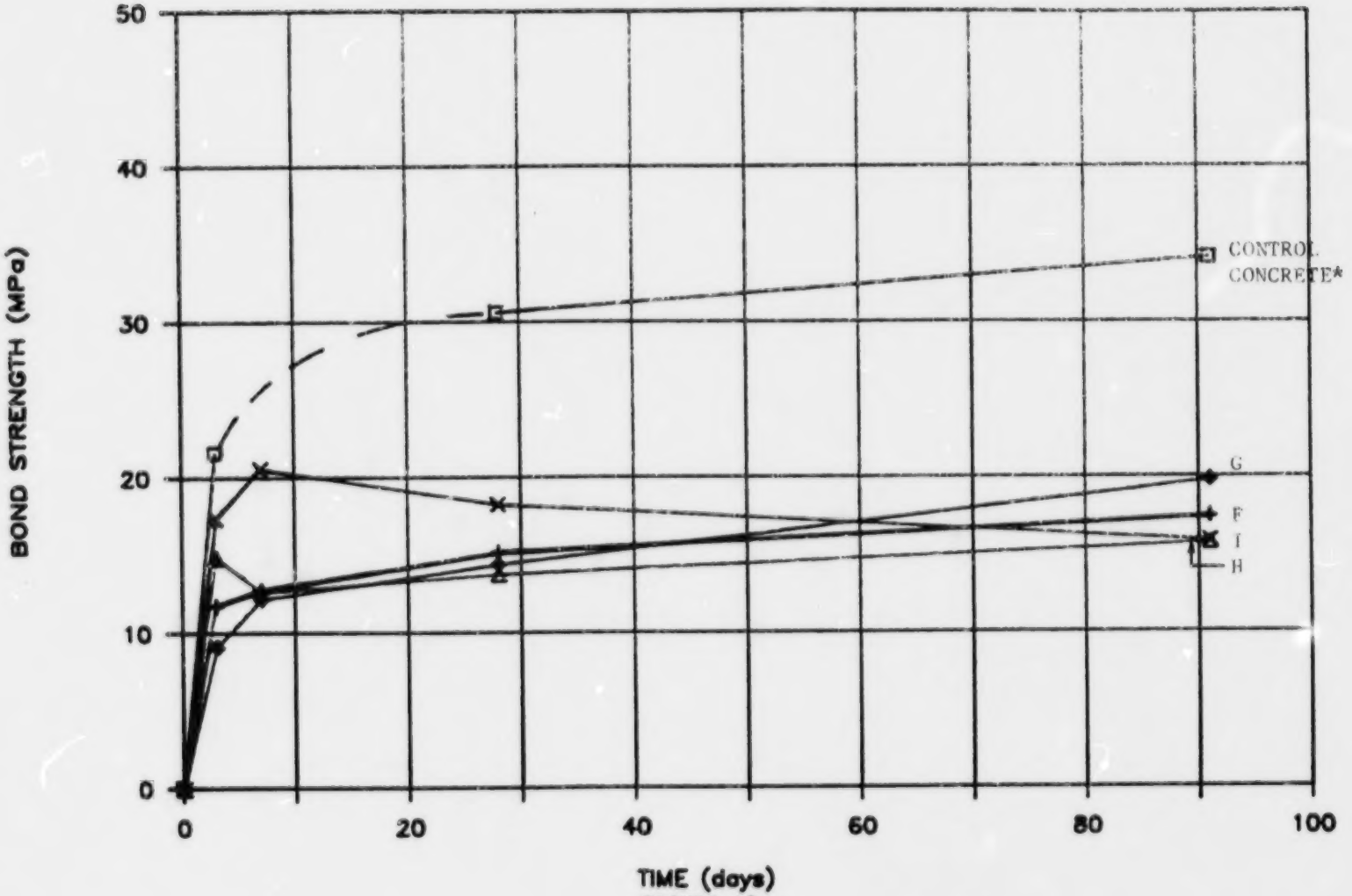


FIGURE A8
BOND STRENGTH OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: F,G,H,I

*7-day test results unreliable and have not been included

APPENDIX B

FLEXURAL STRENGTH OF COMPOSITE SPECIMENS

ASTM C78

APPENDIX B

FLEXURAL STRENGTH OF COMPOSITE SPECIMENS

ASTM C78

This appendix contains graphical representations of the flexural strength data for composite specimens cured under various conditions. The specimens were tested at 3, 7, 28 and 91 days in accordance with ASTM C78 as reported in Section 5.1.2. Descriptions of the curing conditions are given in Section 4.4.

Product	Curing Conditions	Figure
A,B,C,D,E	23°C Wet	B1
F,G,H,I	23°C Wet	B2
A,B,C,D,E	23°C Dry	B3
F,G,H,I	23°C Dry	B4
A,B,C,D,E	38°C/23°C Wet*	B5
F,G,H,I	38°C/23°C Wet*	B6
A,B,C,D,E	-20°C/23°C Wet**	B7
F,G,H,I	-20°C/23°C Wet**	B8

*The specimens were cycled between 23°C wet and 38°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

**The specimens were cycled between 23°C wet and -20°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

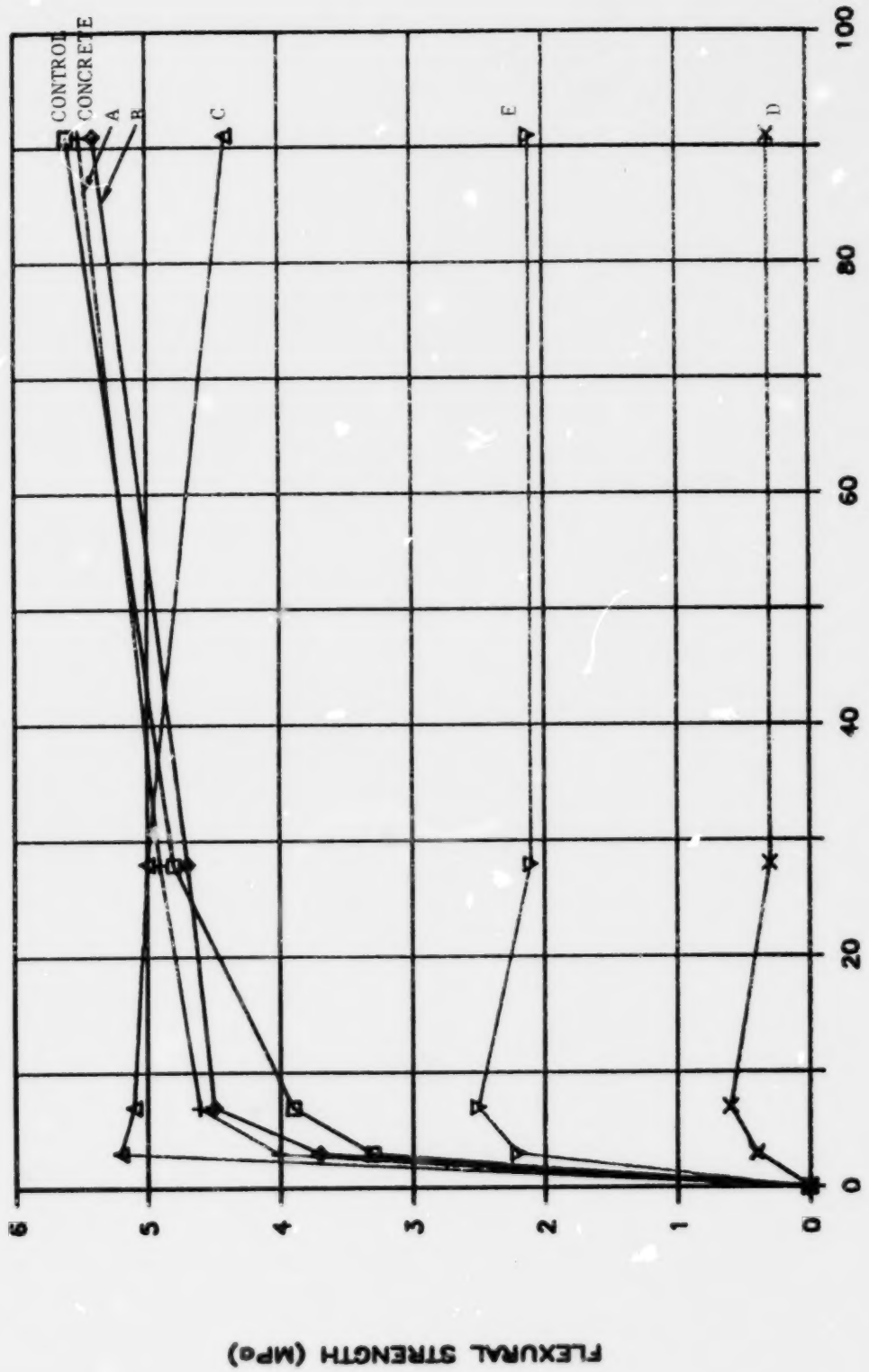


FIGURE B1
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 23°C WET
PRODUCT: A,B,C,D,E

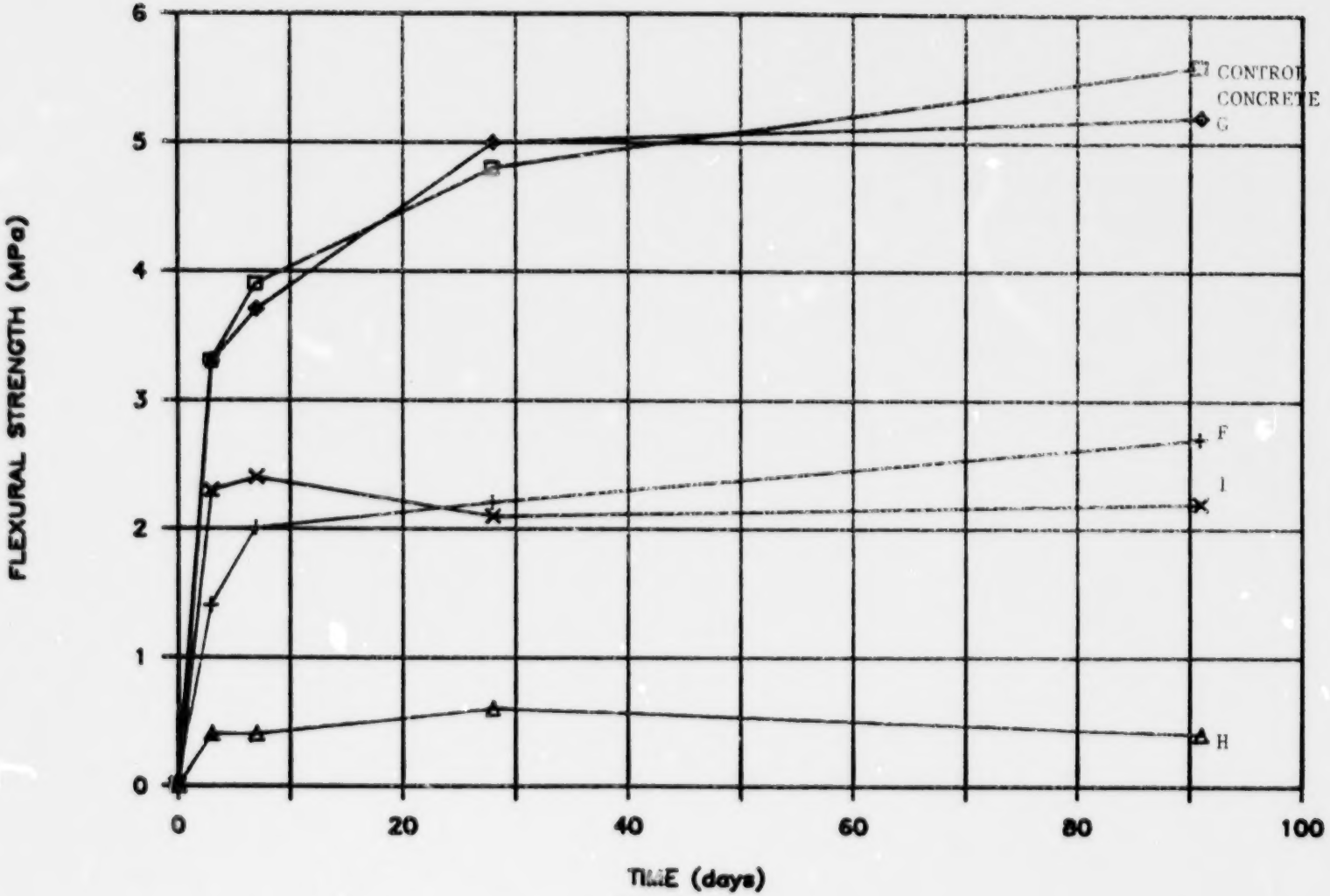


FIGURE B2
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 23°C WET
PRODUCT: F,G,H,I

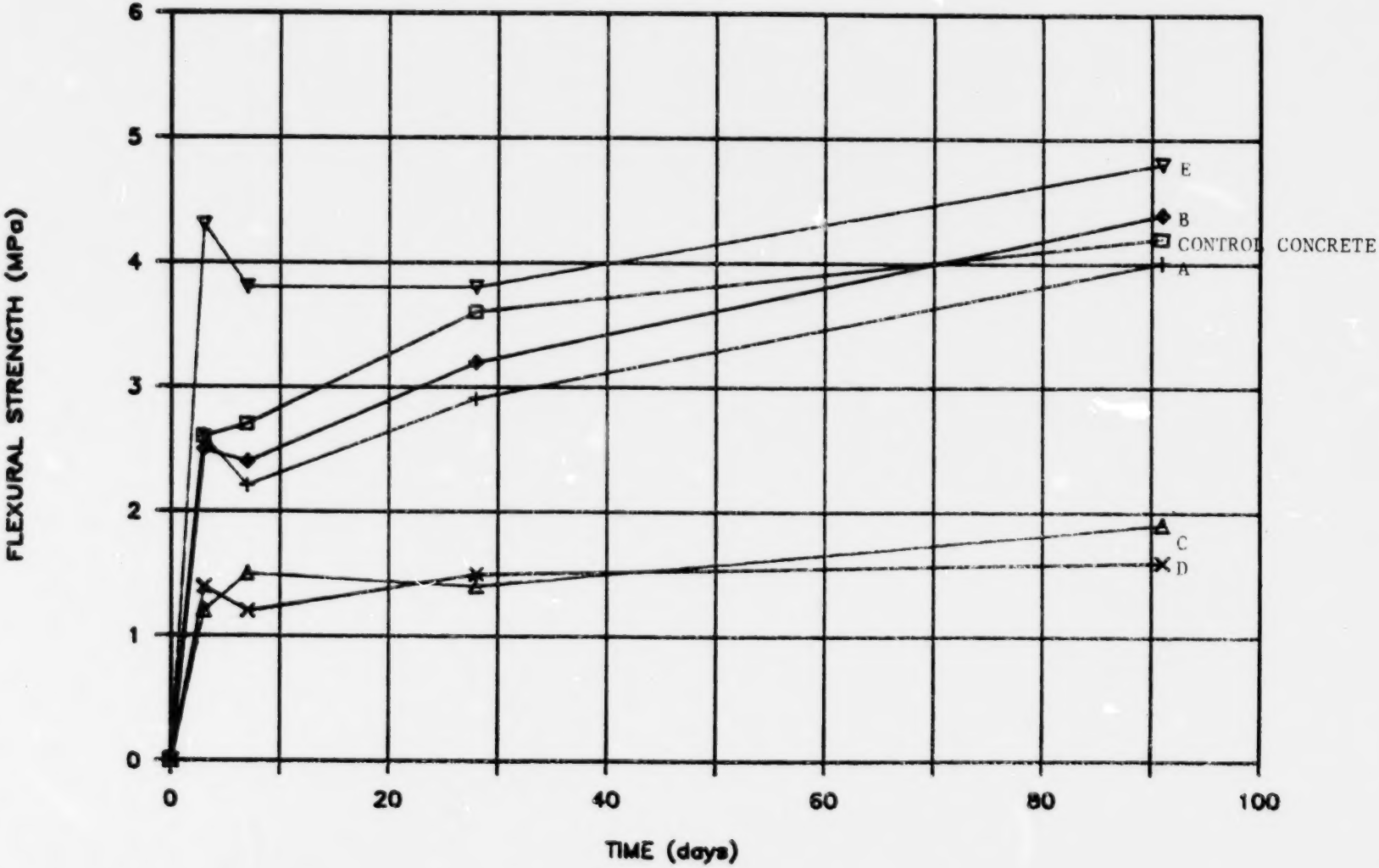


FIGURE B3
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 23°C DRY
PRODUCT: A,B,C,D,E

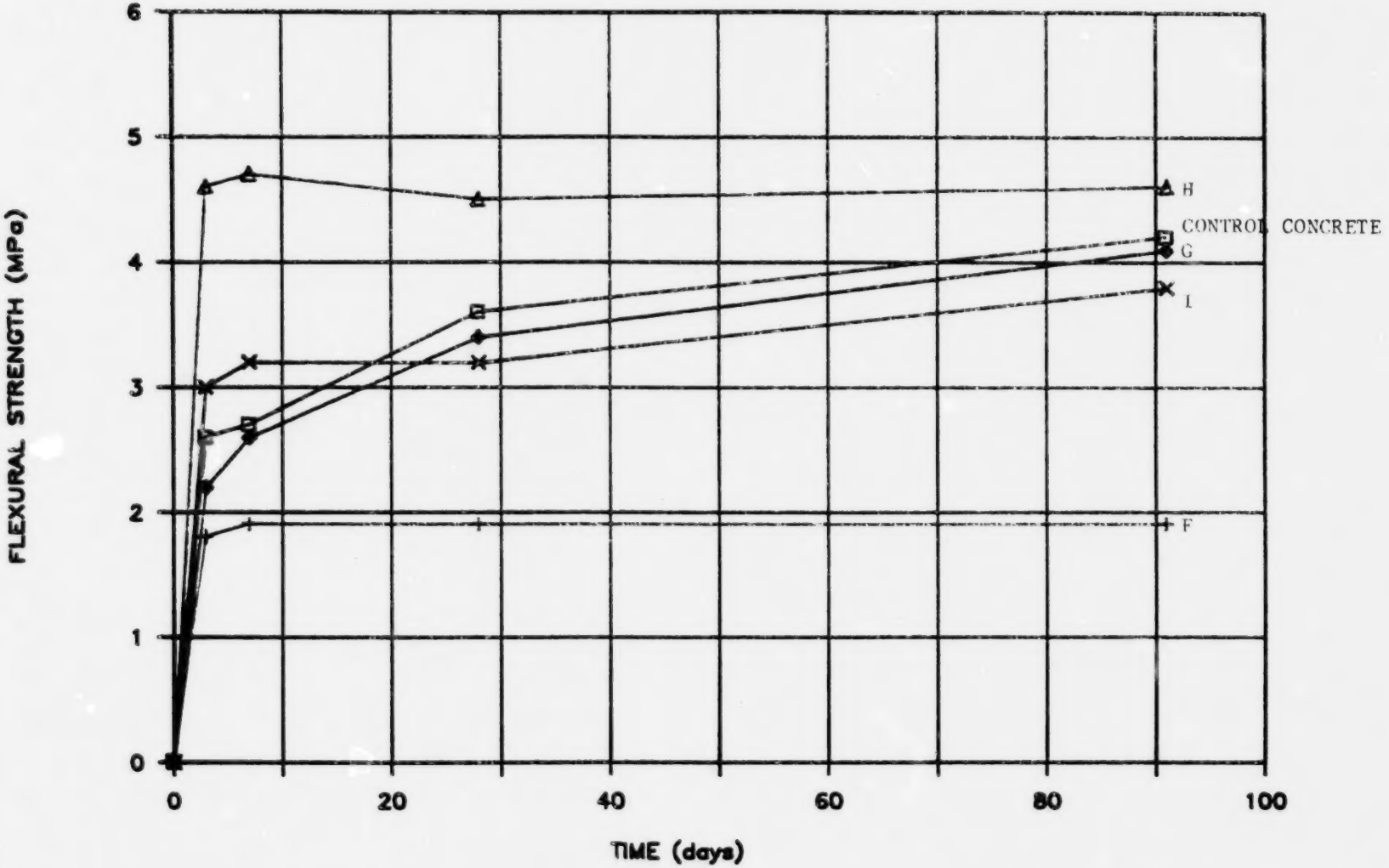


FIGURE B4
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 23°C DRY
PRODUCT: F,G,H,I

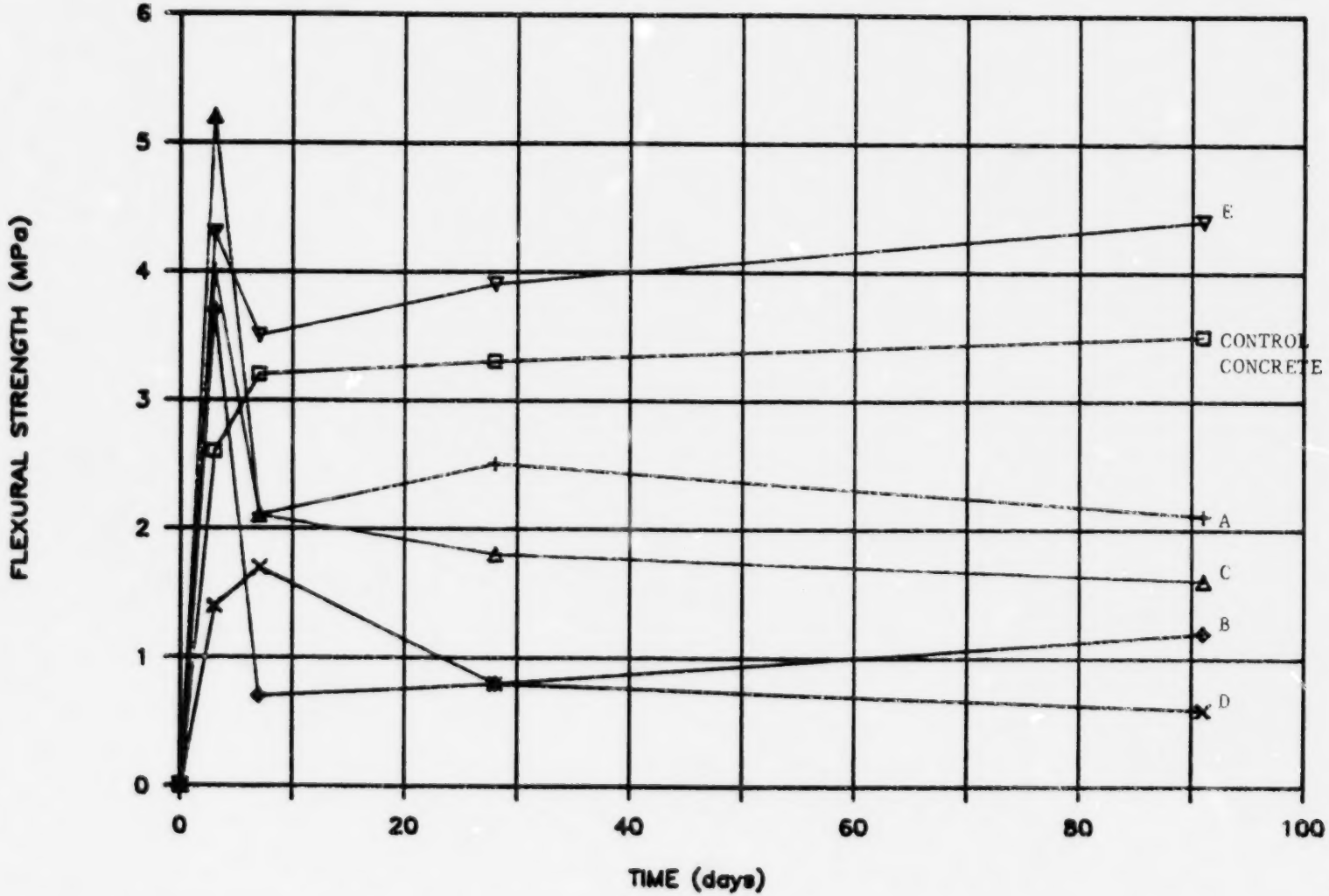


FIGURE B5
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: A,B,C,D,E

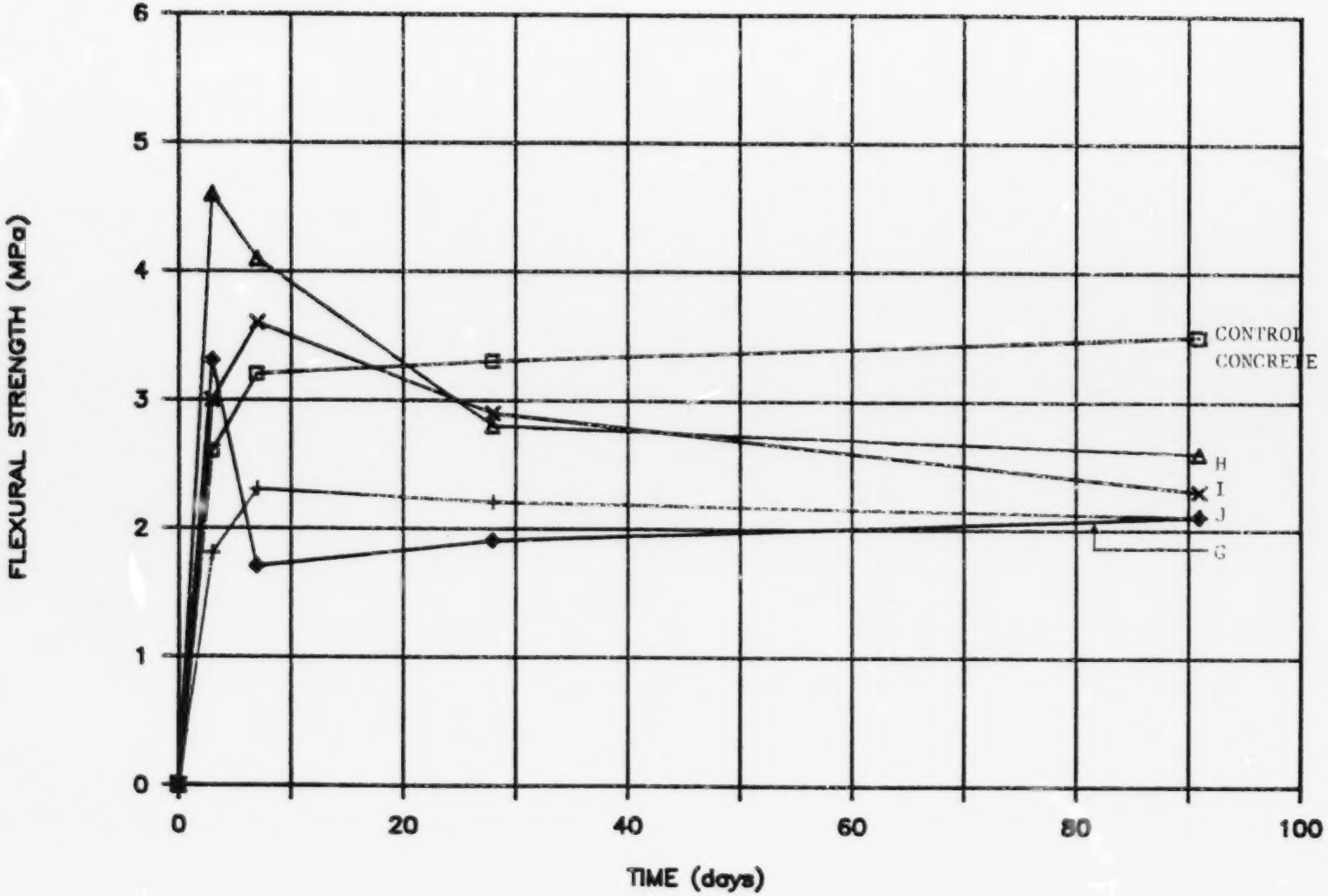


FIGURE B6
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: F,G,H,I

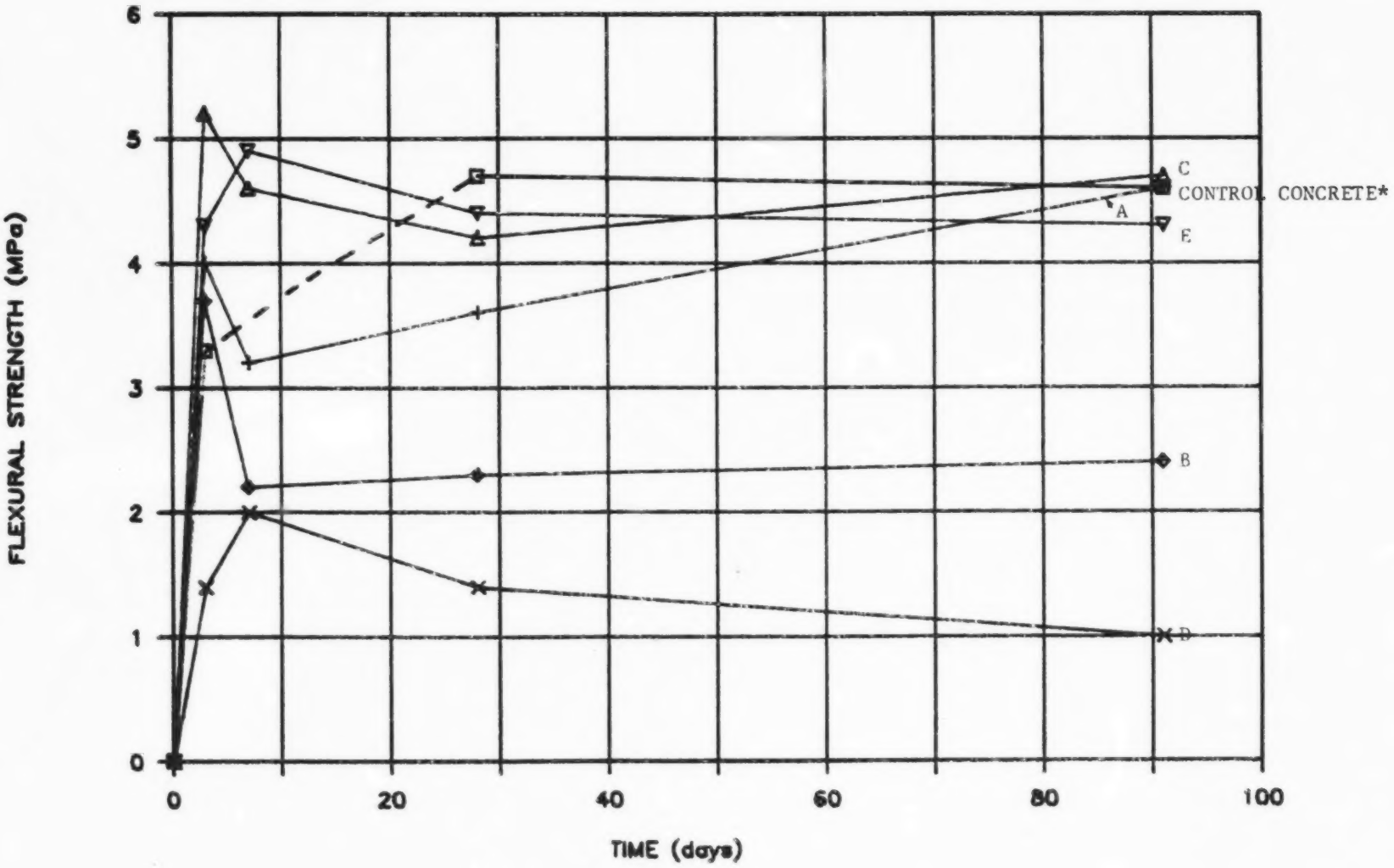


FIGURE B7
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: A,B,C,D,E

*7-day test results unreliable and have not been included

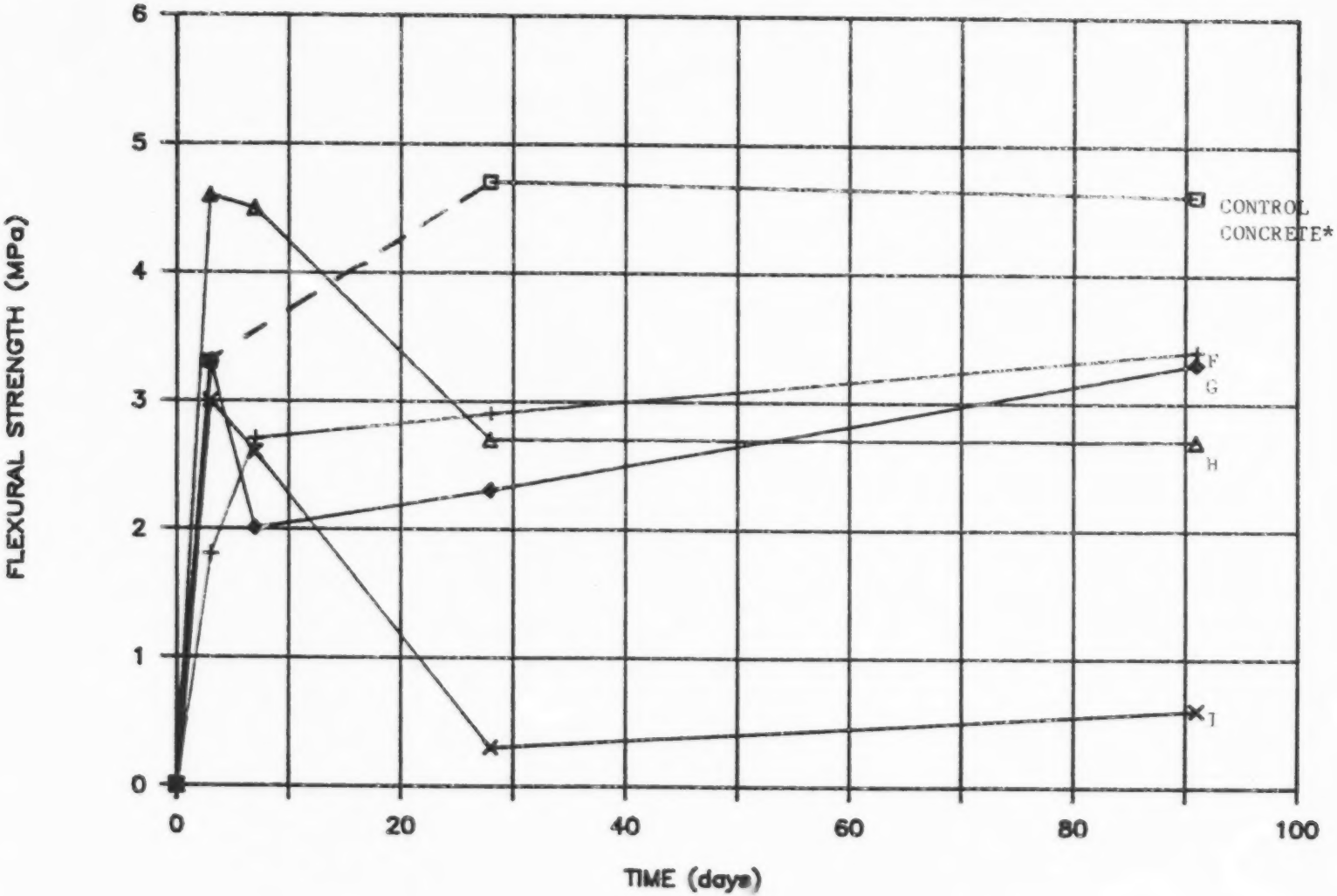


FIGURE B8
FLEXURAL STRENGTH OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: F,G,H,I

*7-day test results unreliable and have not been included

APPENDIX C

ULTRASONIC PULSE VELOCITY MEASUREMENTS OF COMPOSITE SPECIMENS

ASTM C597

APPENDIX C

ULTRASONIC PULSE VELOCITY MEASUREMENTS OF COMPOSITE SPECIMENS

ASTM C597

This appendix contains graphical representations of the ultrasonic pulse velocity measurements taken through the composite specimens prior to the flexural testing. Measurements were taken at 3, 28 and 91 days in accordance with ASTM C597 as reported in Section 5.1.3. Descriptions of the curing conditions are given in Section 4.4.

Product	Curing Conditions	Figure
A,B,C,D,E	23°C Wet	C1
F,G,H,I	23°C Wet	C2
A,B,C,D,E	23°C Dry	C3
F,G,H,I	23°C Dry	C4
A,B,C,D,E	38°C/23°C Wet*	C5
F,G,H,I	38°C/23°C Wet*	C6
A,B,C,D,E	-20°C/23°C Wet**	C7
F,G,H,I	-20°C/23°C Wet**	C8

*The specimens were cycled between 23°C wet and 38°C. The number of cycles for the 28 and 91 day tests were 3 and 8, respectively.

**The specimens were cycled between 23°C wet and -20°C. The number of cycles for the 28 and 91 day tests were 3 and 8, respectively.

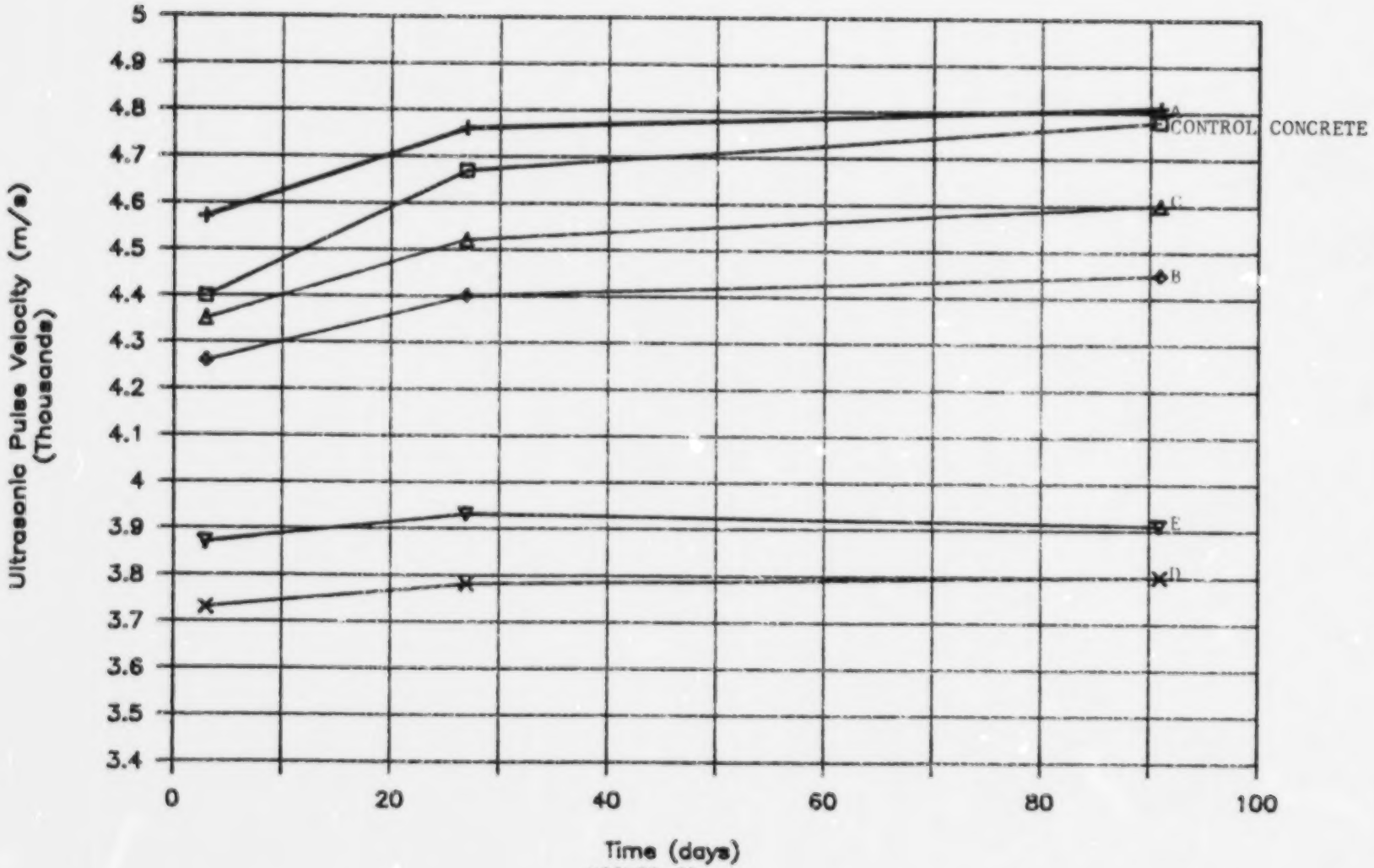


FIGURE C1
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 23°C WET
PRODUCT: A,B,C,D,E

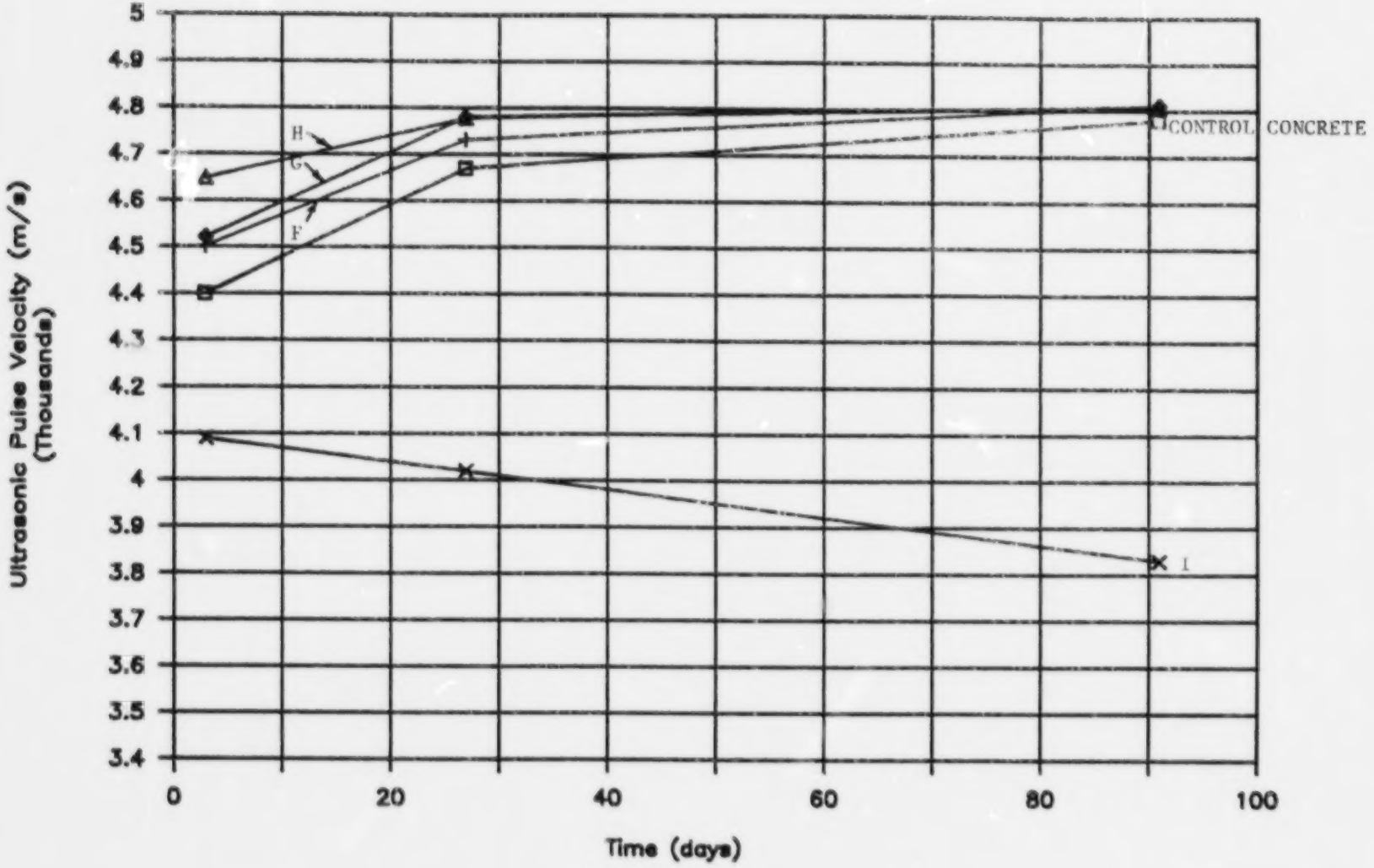


FIGURE C2
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 23°C WET
PRODUCT: F,G,H,I

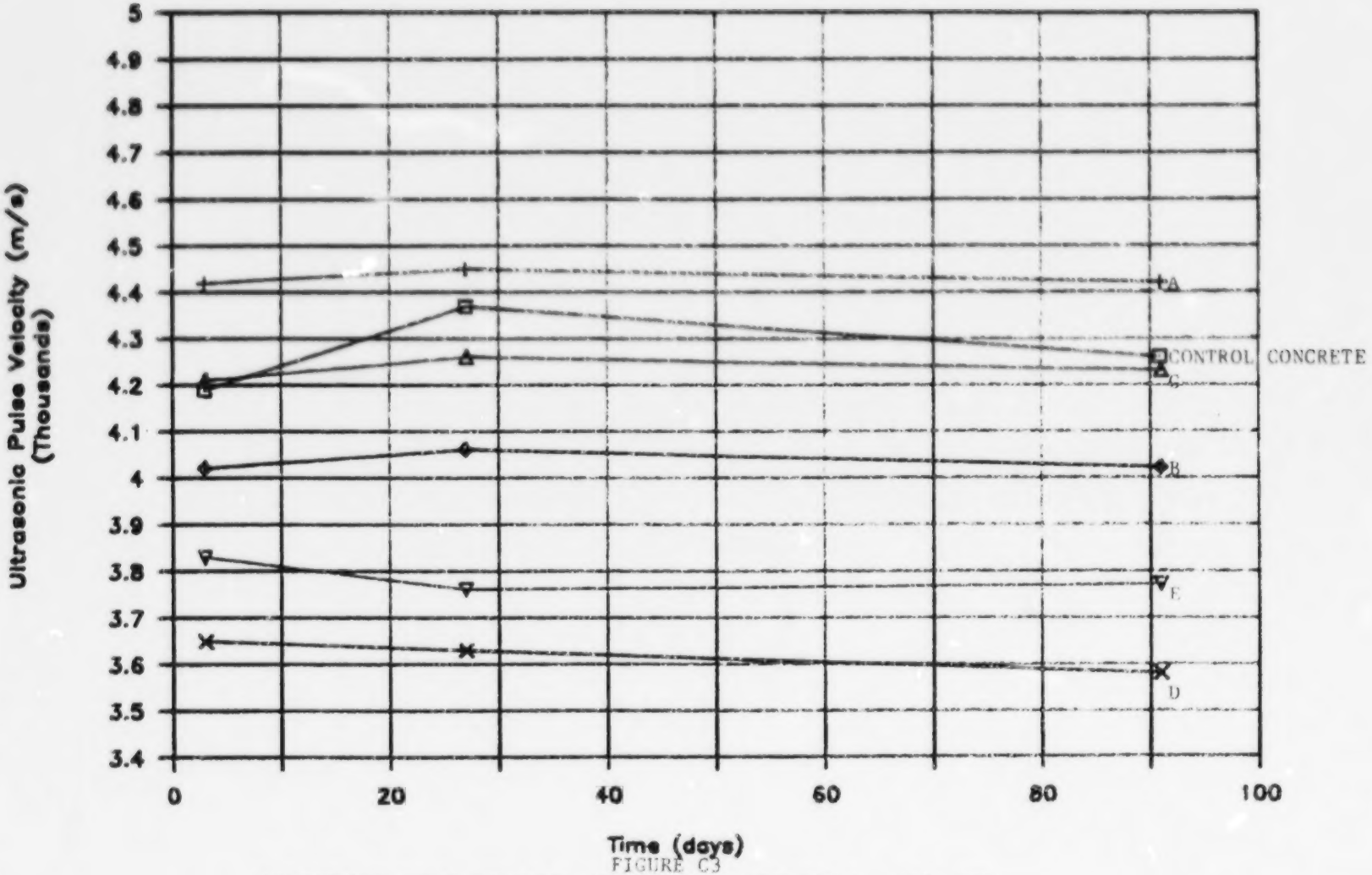


FIGURE C3

ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 23°C DRY

PRODUCT: A,B,C,D,E

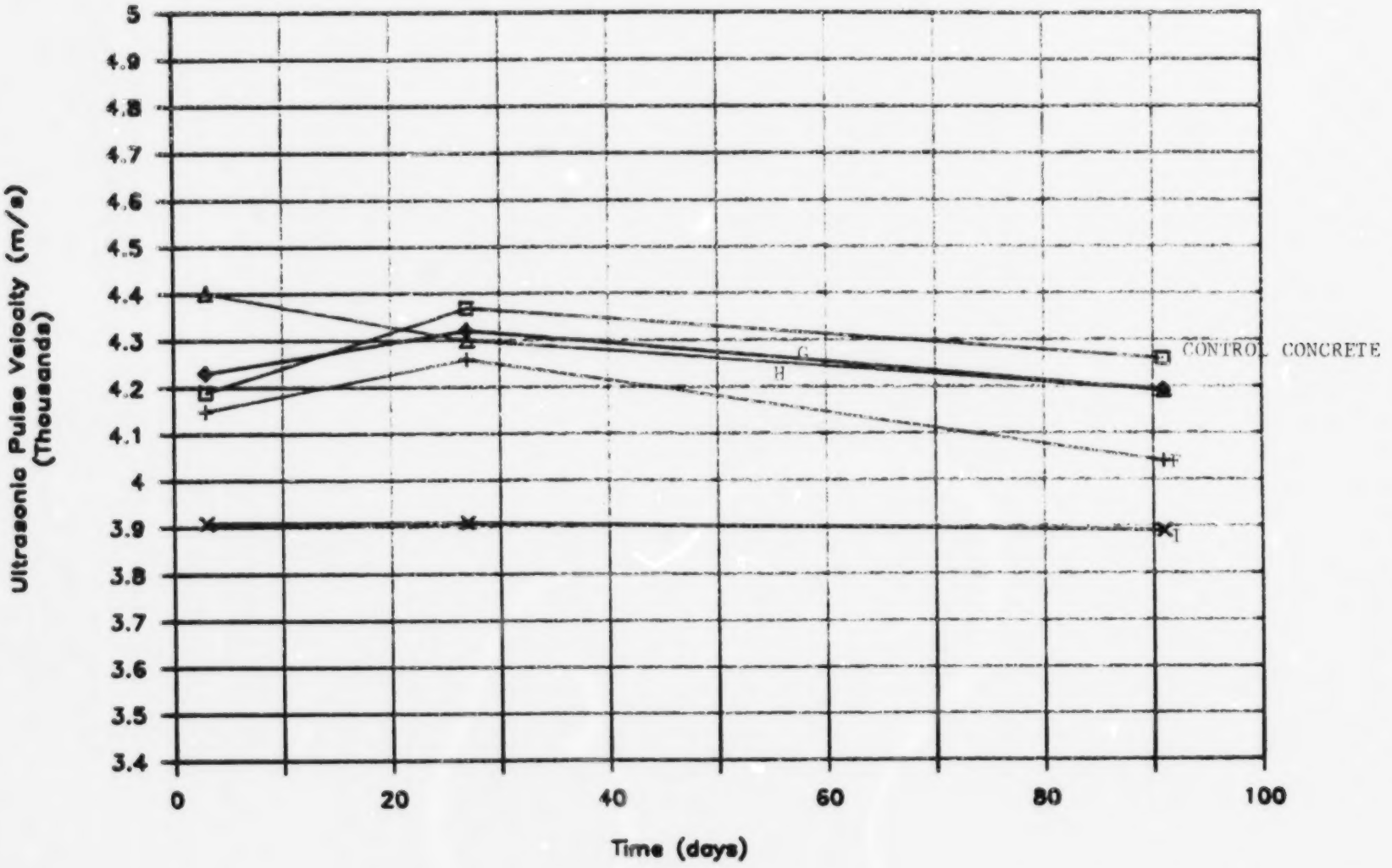


FIGURE C4
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 23°C DRY
PRODUCT: F,G,H,I

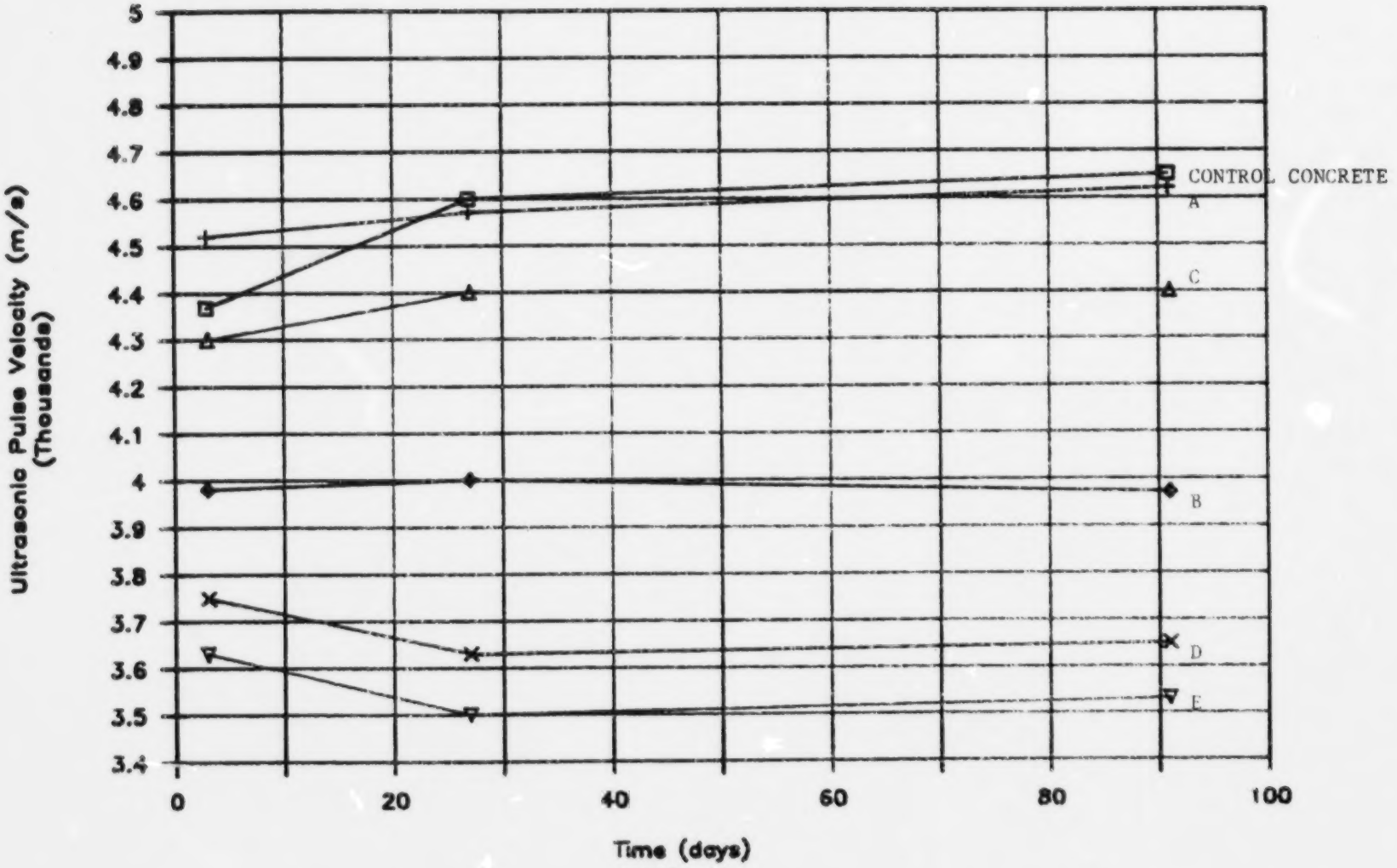


FIGURE C5
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: A,B,C,D,E

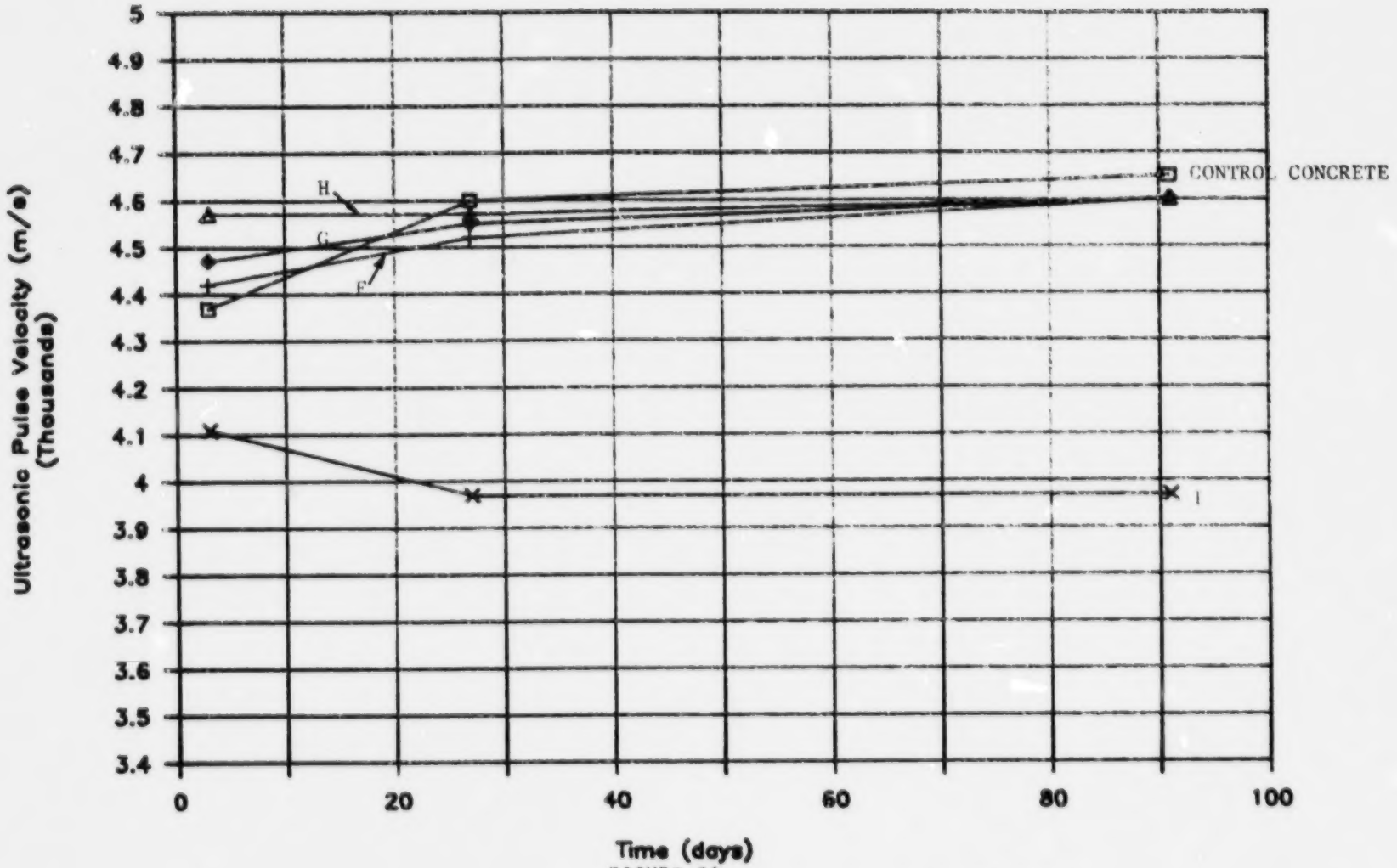


FIGURE C6
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: 38°C/23°C WET
PRODUCT: F,G,H,I

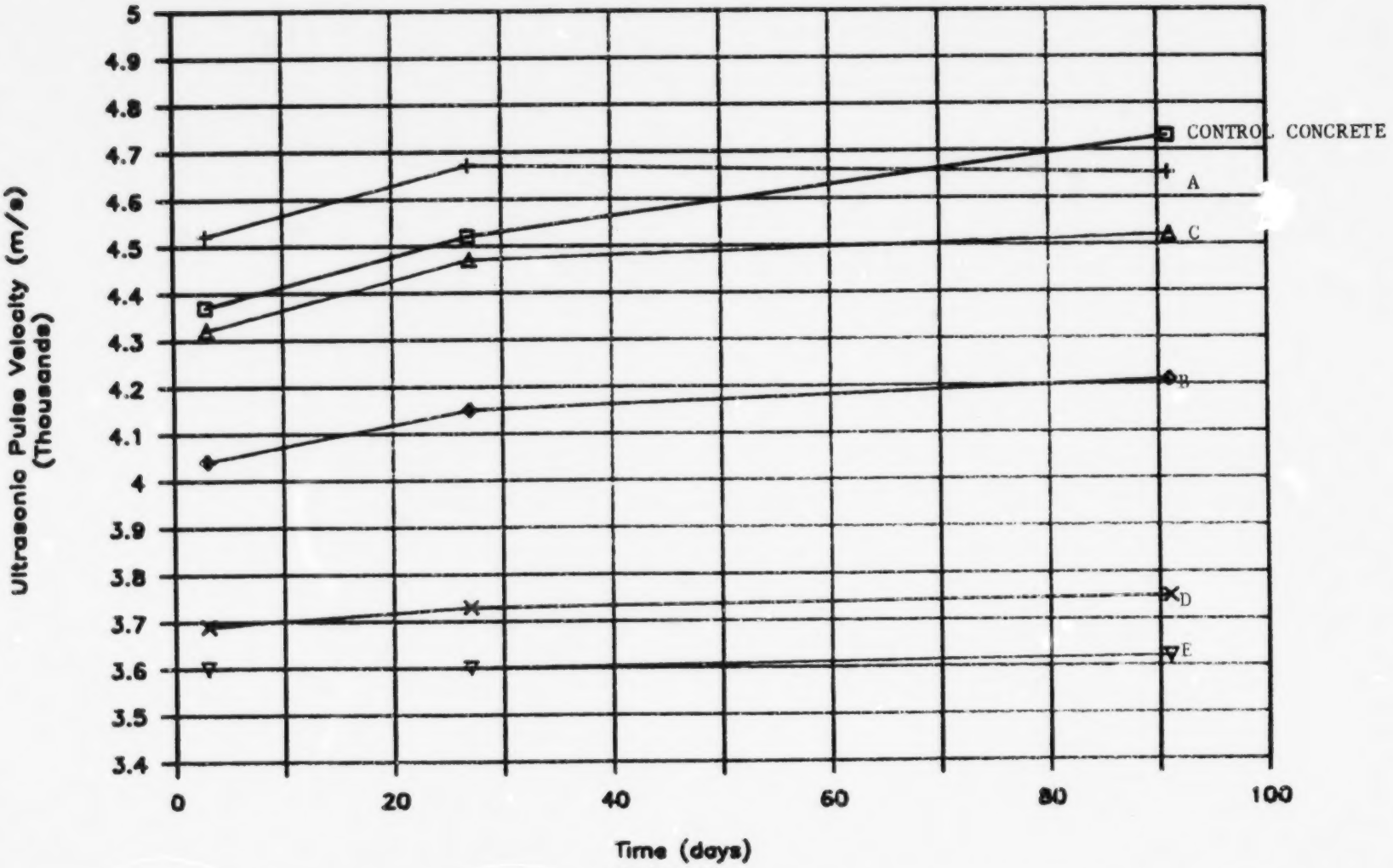


FIGURE C7

ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: A,B,C,D,E

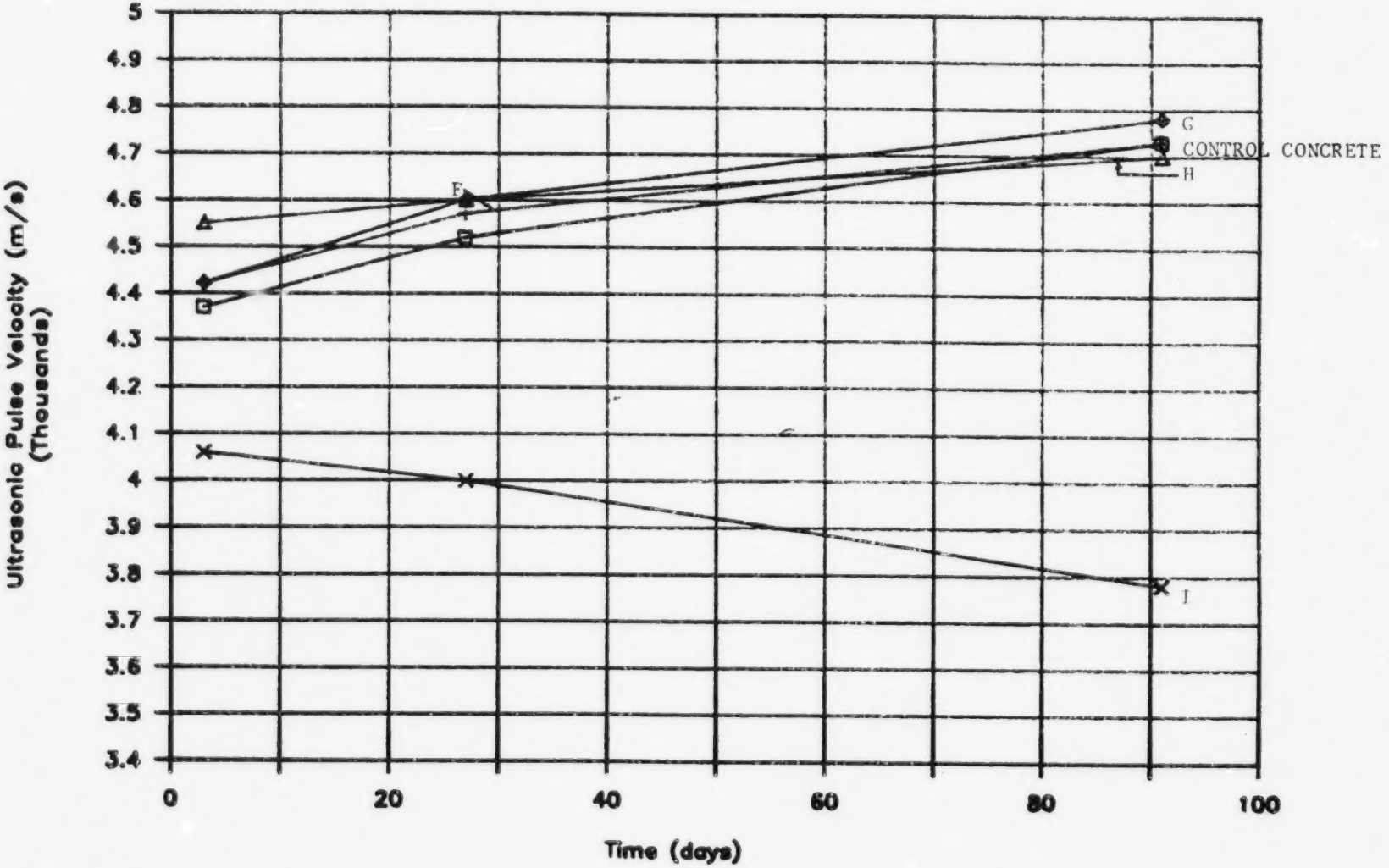


FIGURE C8
ULTRASONIC PULSE VELOCITY OF COMPOSITE SPECIMENS: -20°C/23°C WET
PRODUCT: F,G,H,I

APPENDIX D

COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS

ASTM C39, C109

APPENDIX D

COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS

ASTM C39, C109

This appendix contains graphical representations of the compressive strength results for tests on specimens of repair materials cured under various conditions. The specimens were tested at 7, 28 and 91 days as reported in Section 5.2.1. The testing was conducted in accordance with ASTM C39, except for Products G and H which were tested in accordance with ASTM C109. Descriptions of the curing conditions are given in Section 4.4.

Product	Curing Conditions	Figure
A,B,C,D	23°C Wet	D1
E,G,H,I	23°C Wet	D2
A,B,C,D	23°C Dry	D3
E,G,H,I	23°C Dry	D4
A,B,C,D	38°C/23°C Wet*	D5
E,I	38°C/23°C Wet*	D6
A,B,C,D	-20°C/23°C Wet**	D7
E,I	-20°C/23°C Wet**	D8

*The specimens were cycled between 23°C wet and 38°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

**The specimens were cycled between 23°C wet and -20°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

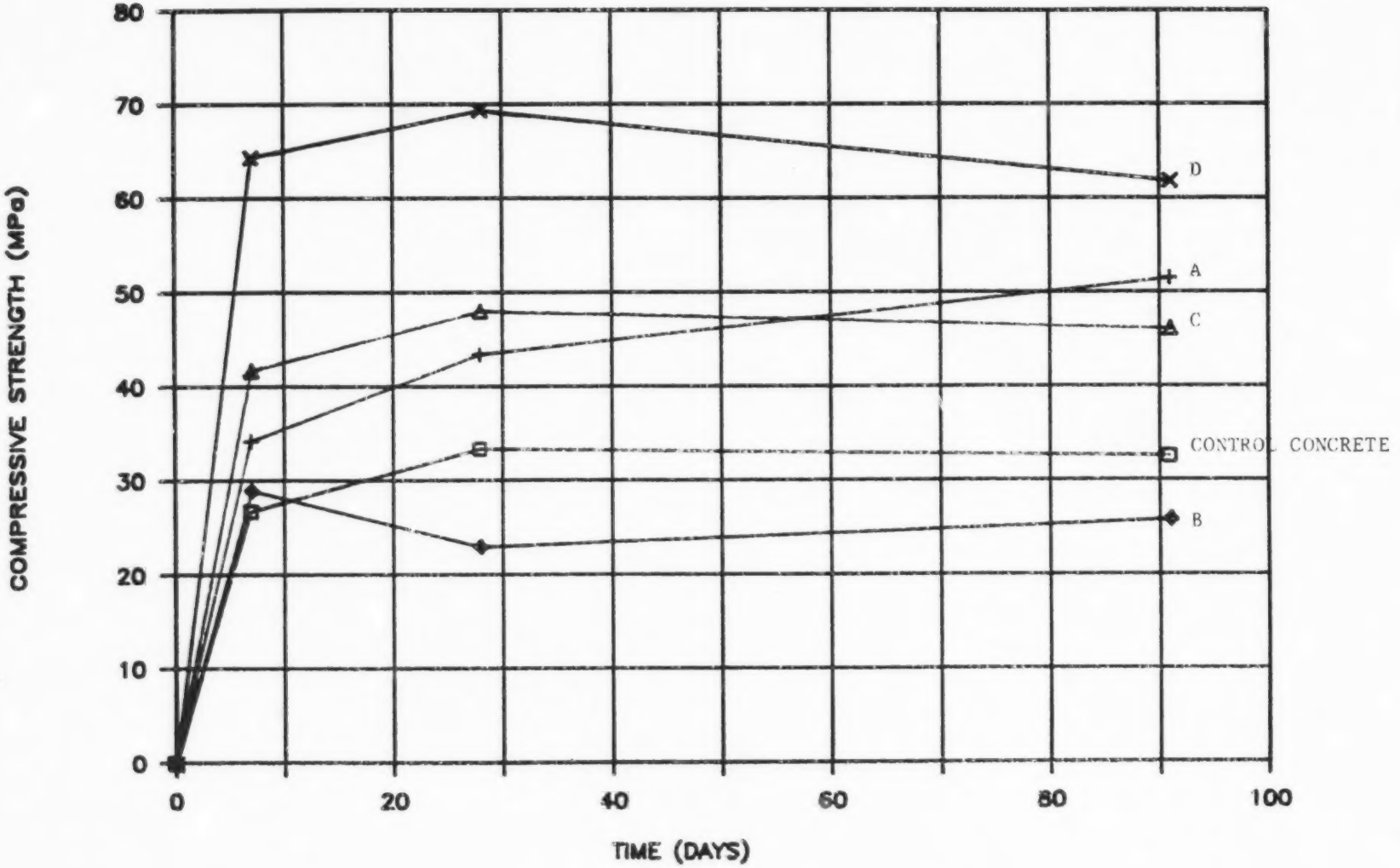


FIGURE D1
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 23°C WET
PRODUCT: A,B,C,D

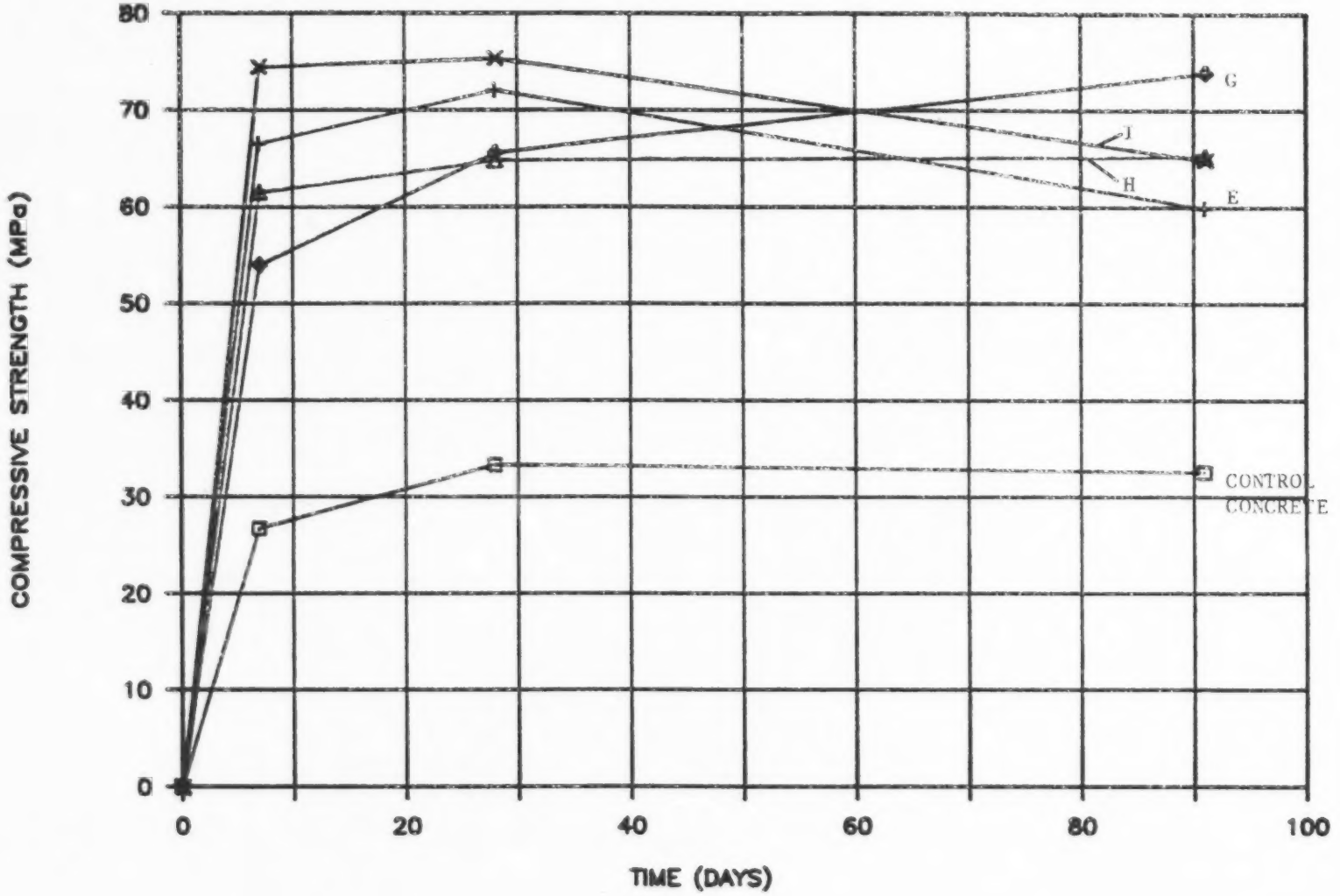


FIGURE D2
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 23°C WET
PRODUCT: E,G,H,I

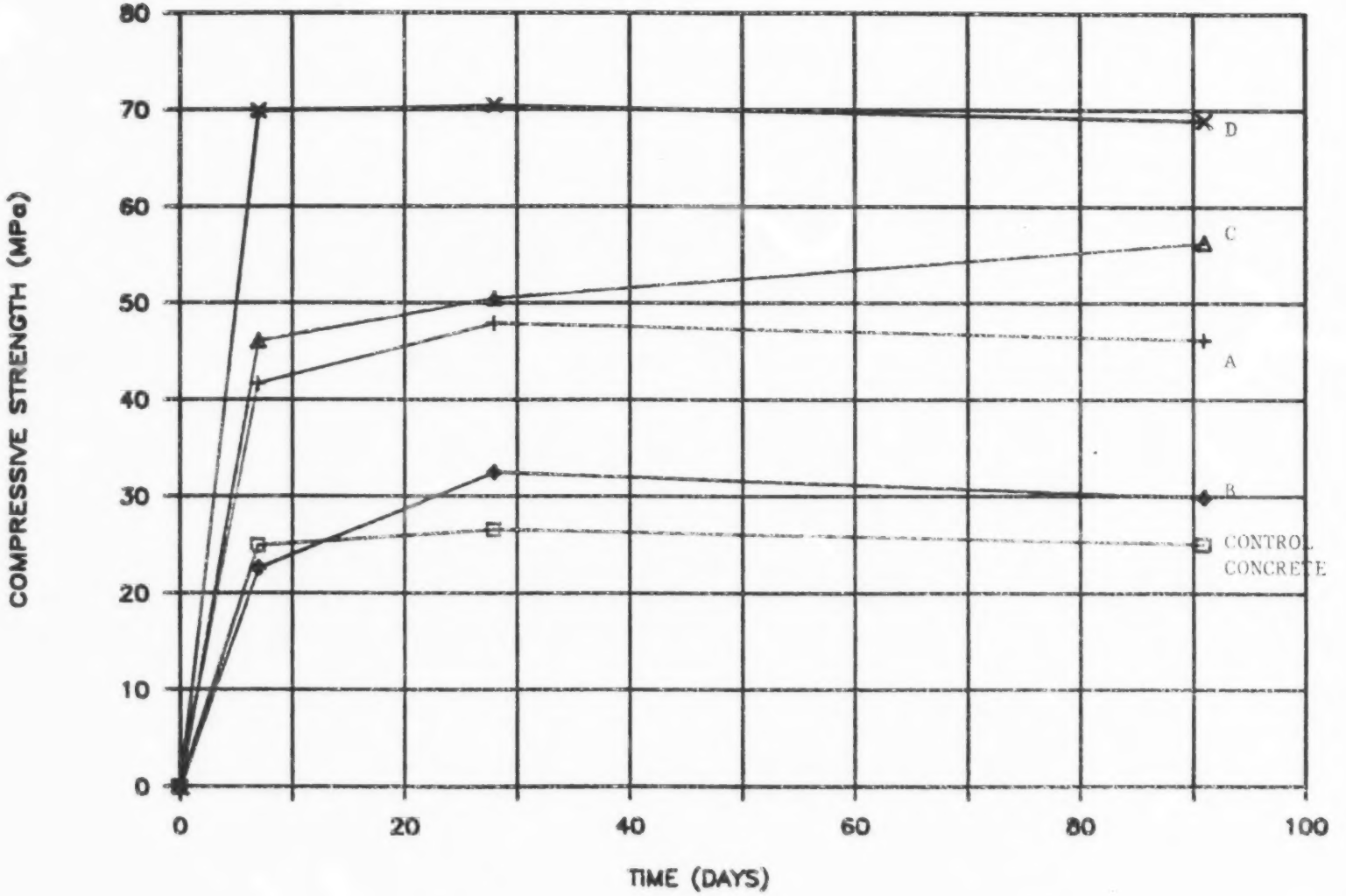


FIGURE D3
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 23°C DRY
PRODUCT: A,B,C,D

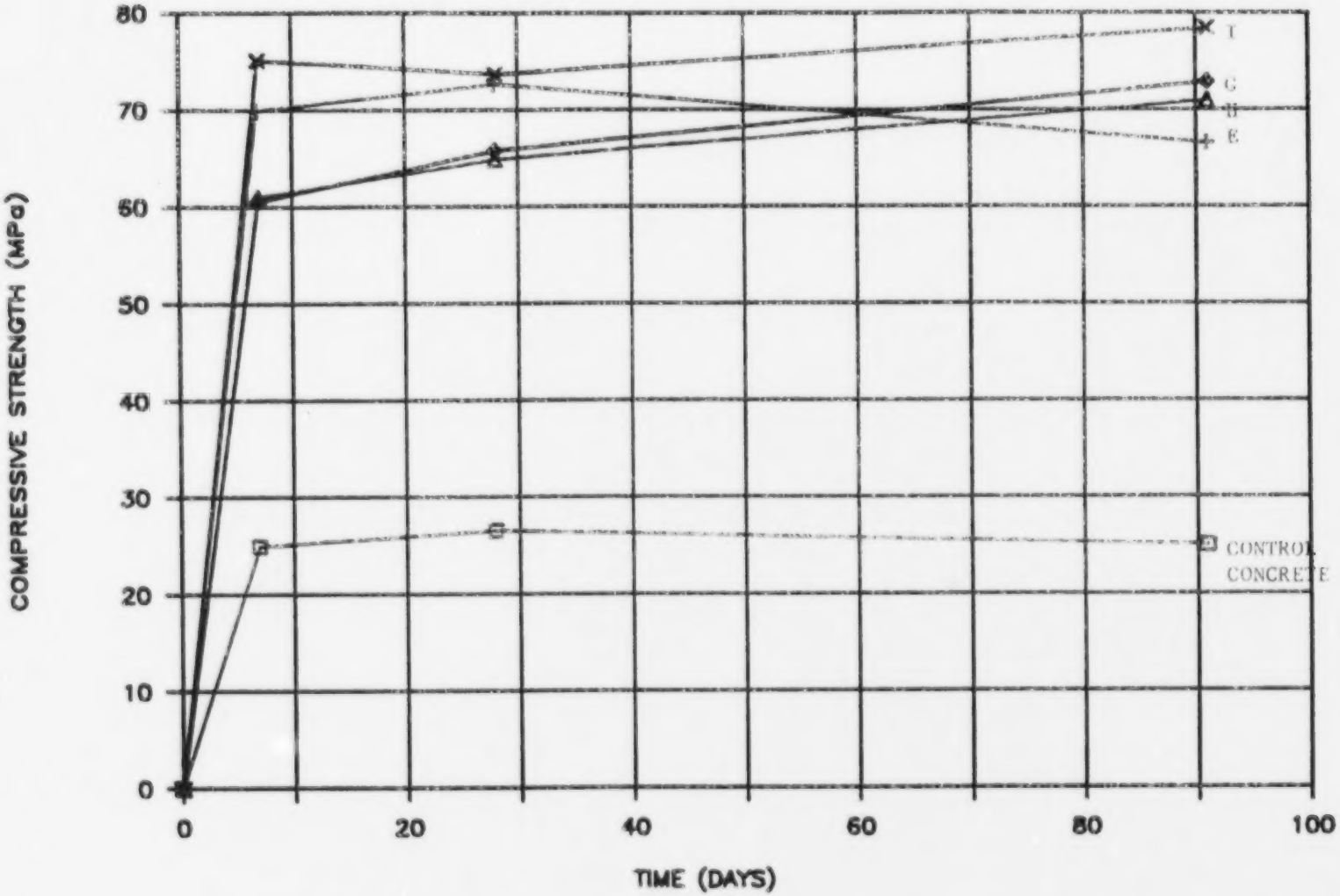


FIGURE D4
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 23°C DRY
PRODUCT: E,G,H,I

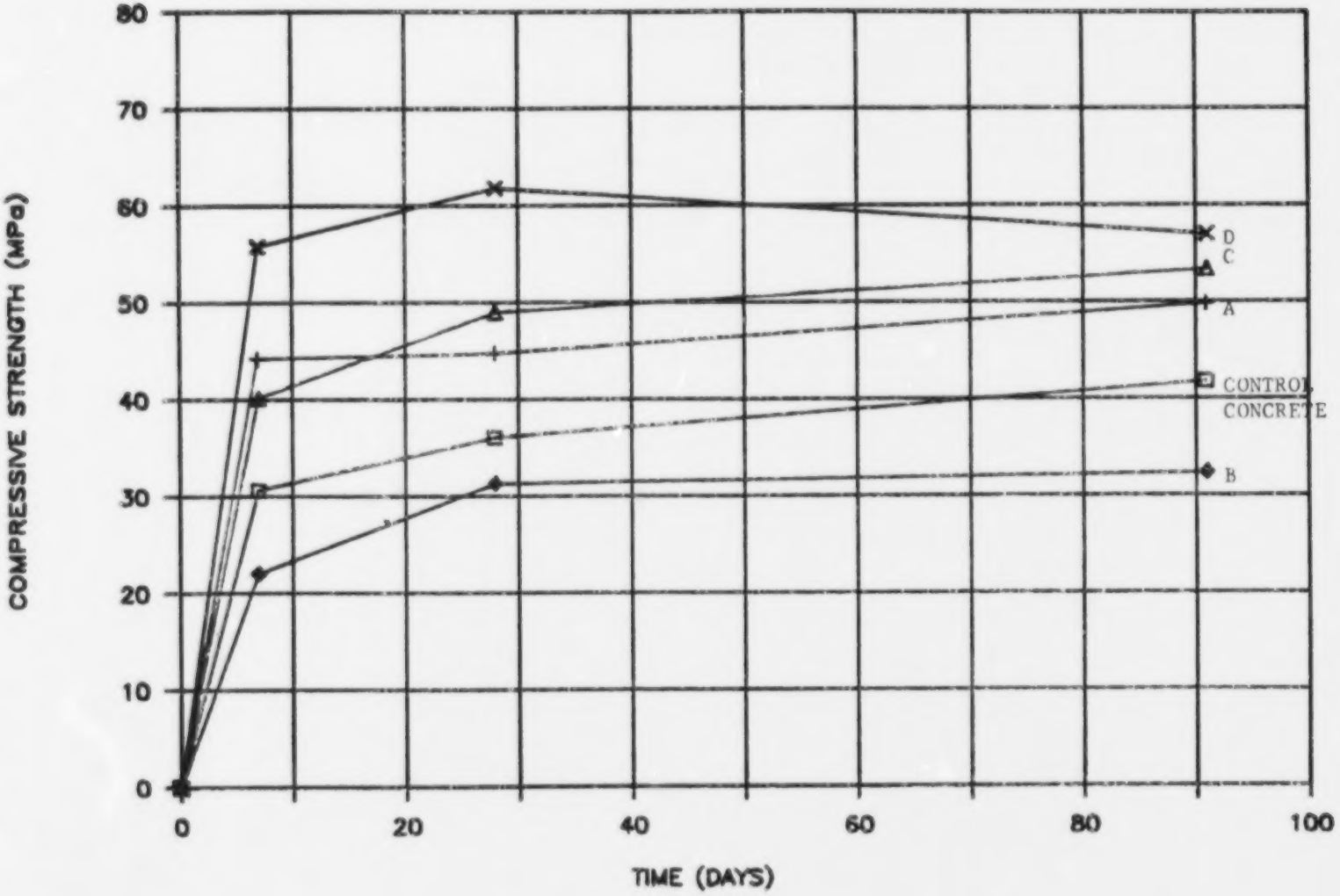


FIGURE D5
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 38°C/23°C WET
PRODUCT: A,B,C,D

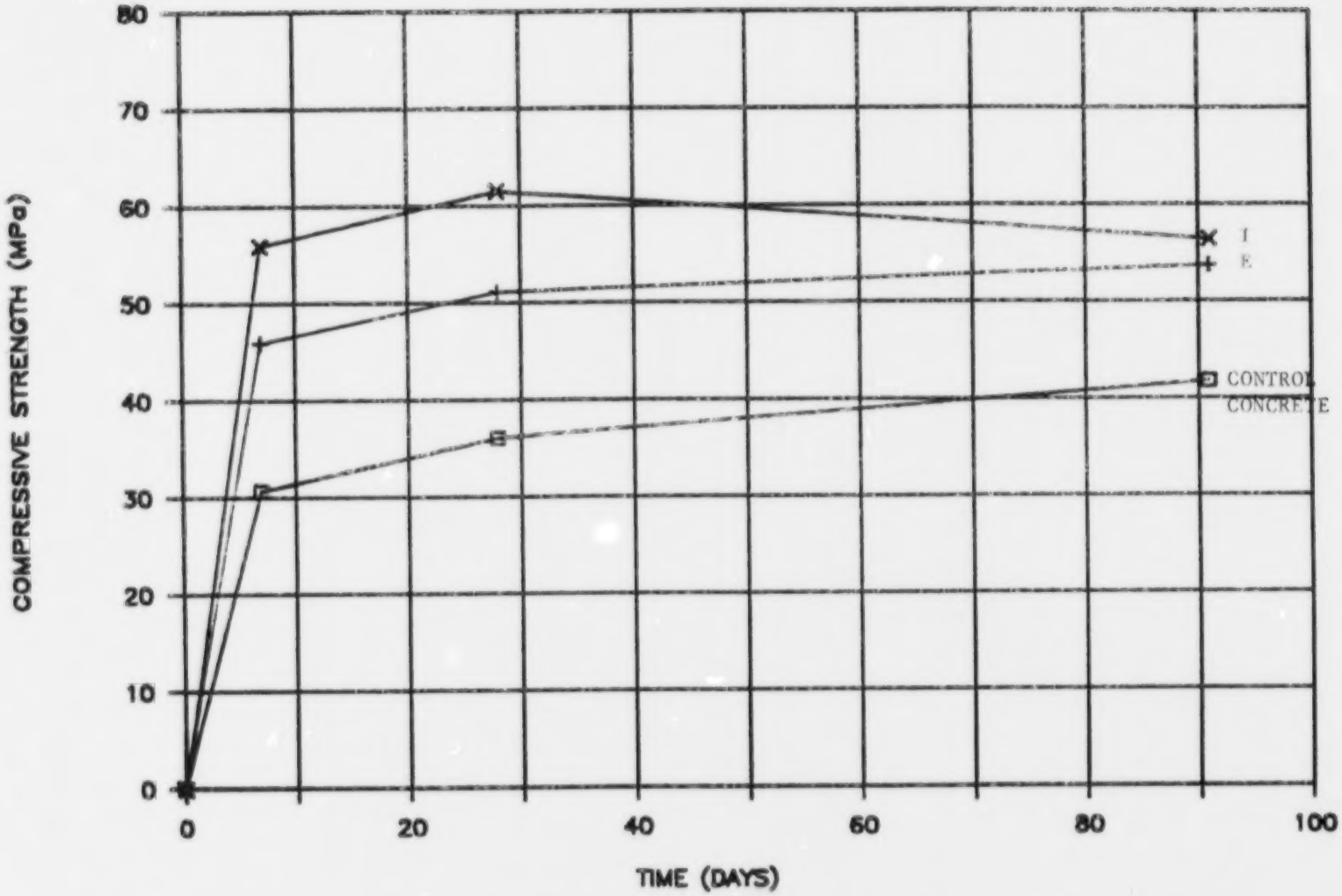


FIGURE D6
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: 38°C/23°C WET
PRODUCT: E,I

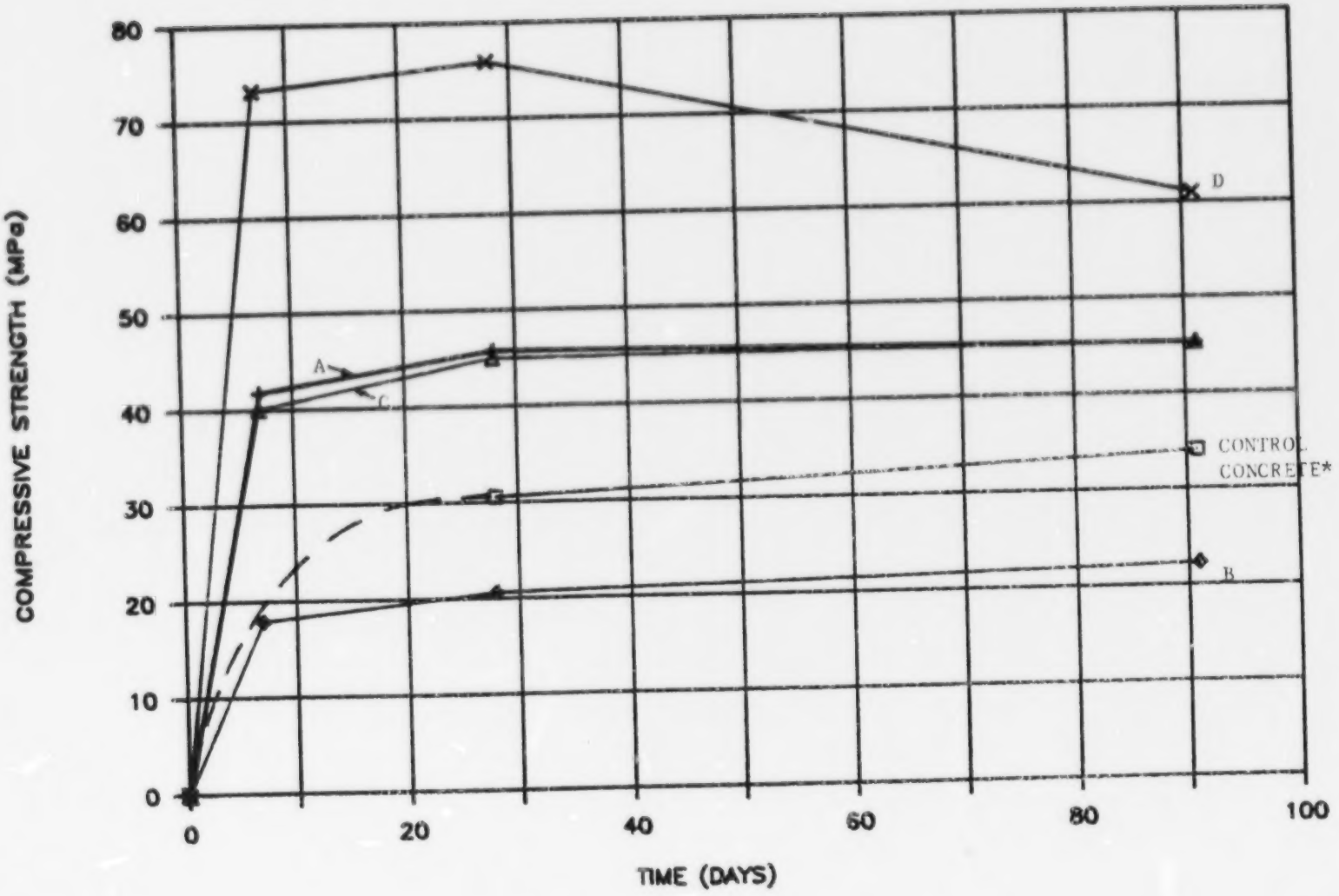


FIGURE D7
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: -20°C/23°C WET
PRODUCT: A,B,C,D

*7-day test results unreliable and have not been included

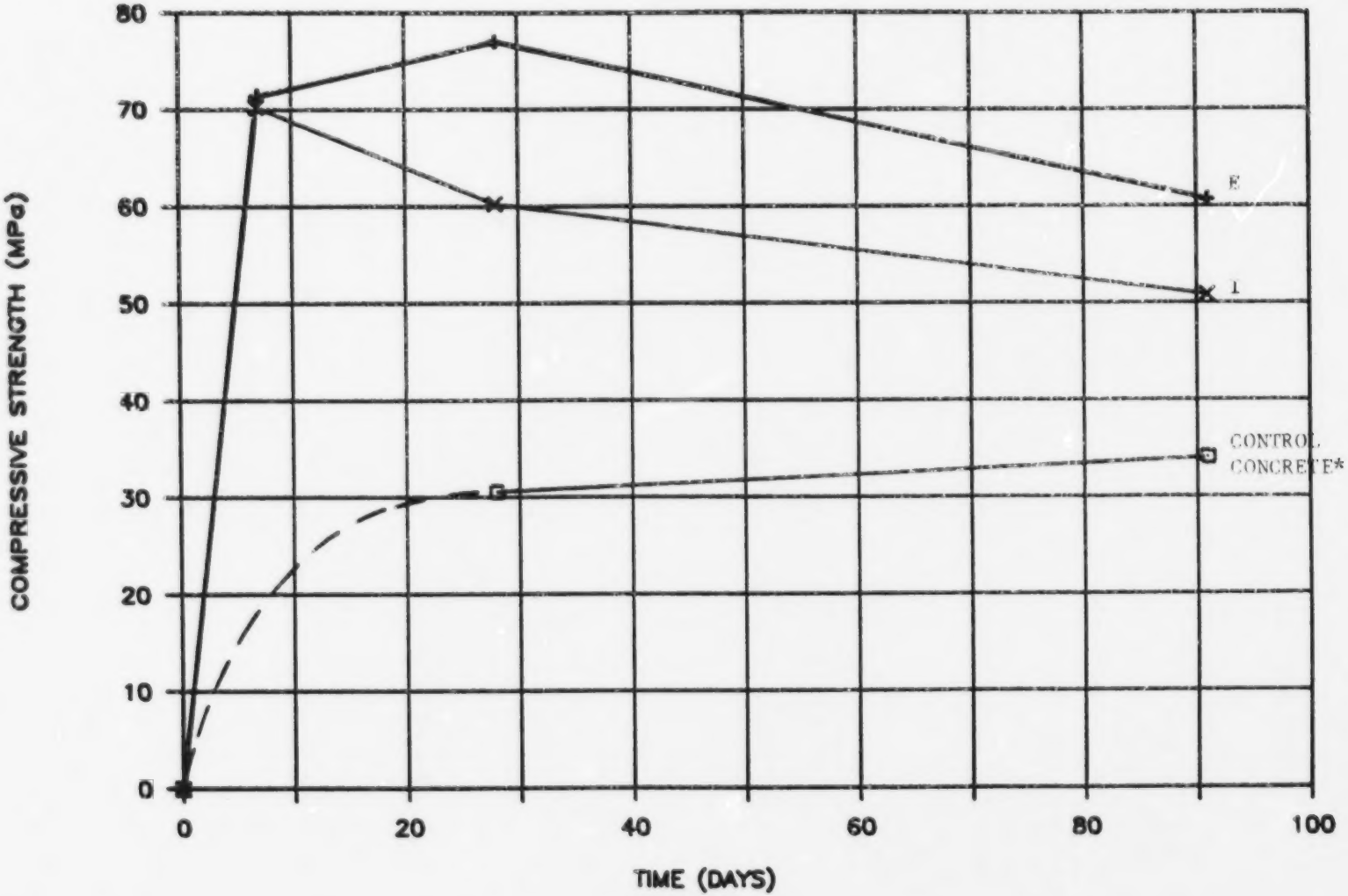


FIGURE D8
COMPRESSIVE STRENGTH OF REPAIR MATERIAL SPECIMENS: -20°C/23°C WET
PRODUCT: E,I

*7-day test results unreliable and have not been included

APPENDIX E

MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS

ASTM C469

APPENDIX E

MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS

ASTM C469

This appendix contains graphical representations of the modulus of elasticity test data for repair material specimens cured under various conditions. Specimens were made from the patching materials only. The tests were conducted at 7, 28 and 91 days in accordance with ASTM C469 as reported in Section 5.2.2. Description of the curing conditions are given in Section 4.4

Product	Curing Conditions	Figure
A,B,C,D	23°C Wet	E1
E,I	23°C Wet	E2
A,B,C,D	23°C Dry	E3
E,I	23°C Dry	E4
A,B,C,D	38°C/23°C Wet*	E5
E,I	38°C/23°C Wet*	E6
A,B,C,D	-20°C/23°C Wet**	E7
E,I	-20°C/23°C Wet**	E8

*The specimens were cycled between 23°C wet and 38°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

**The specimens were cycled between 23°C wet and -20°C. The number of cycles for the 7, 28 and 91 day tests were 1, 3 and 8, respectively.

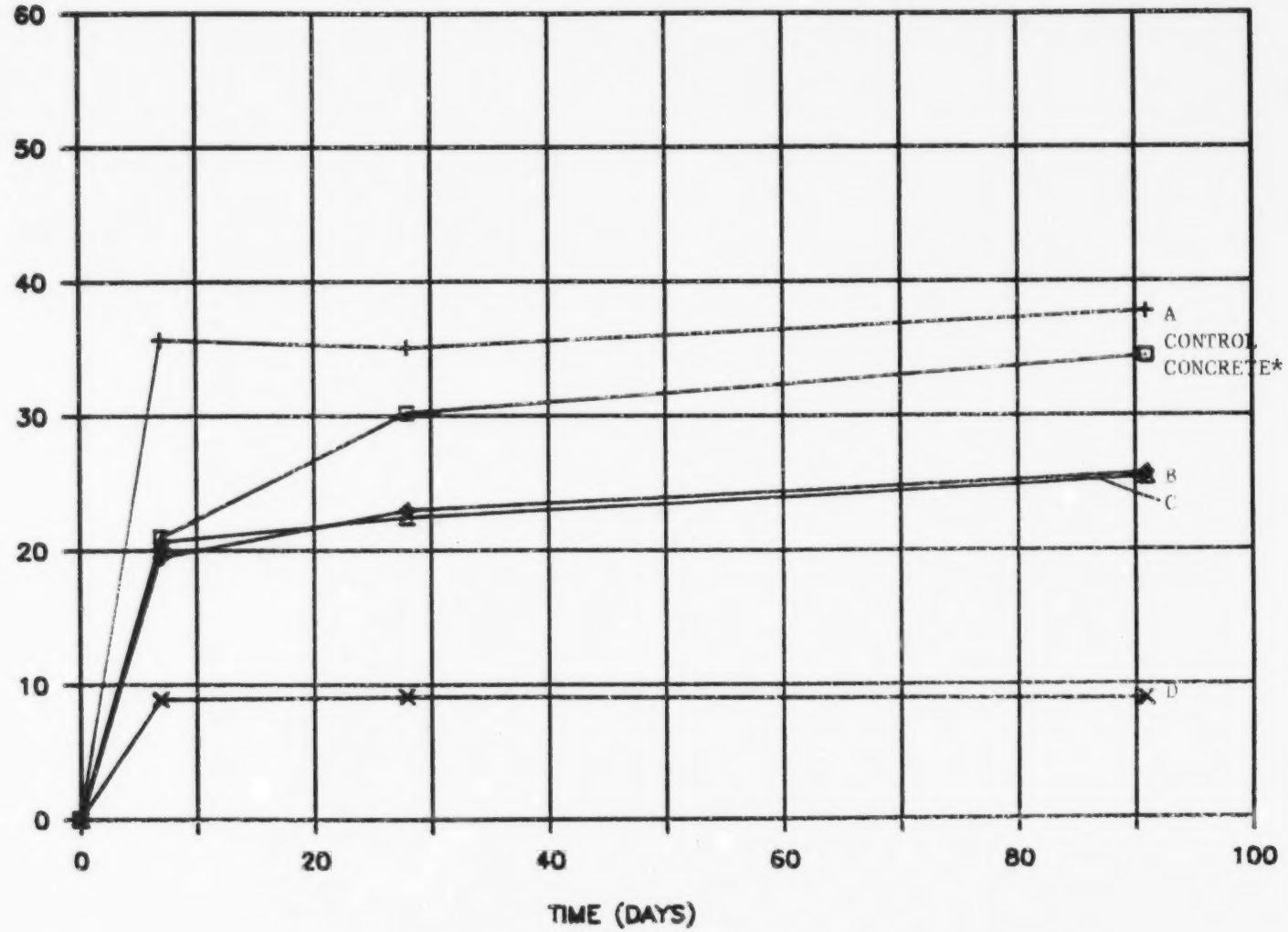


FIGURE E1
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 23°C WET
PRODUCT: A,B,C,D

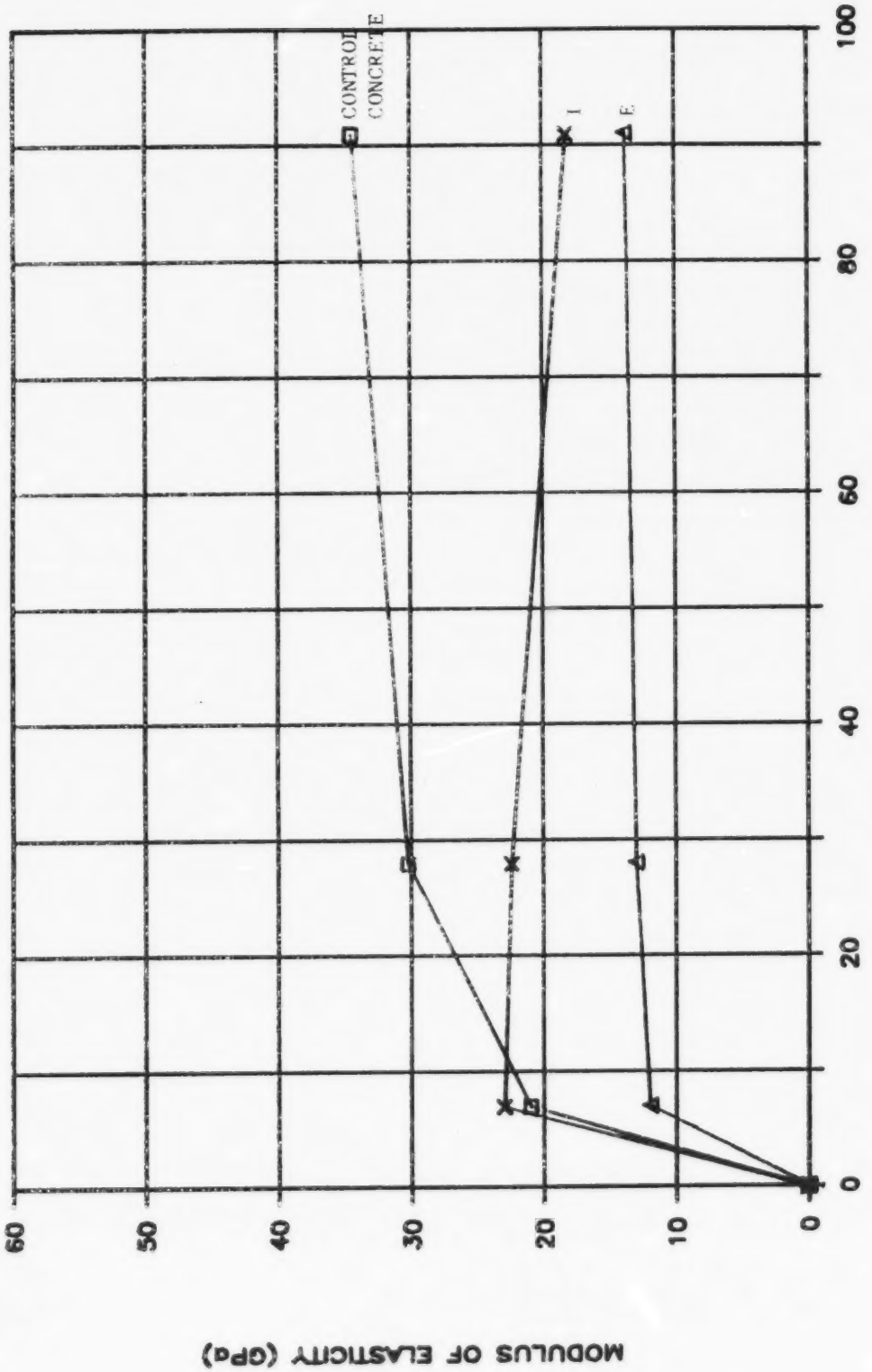


FIGURE E2

MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 23°C WET
PRODUCT: E,I

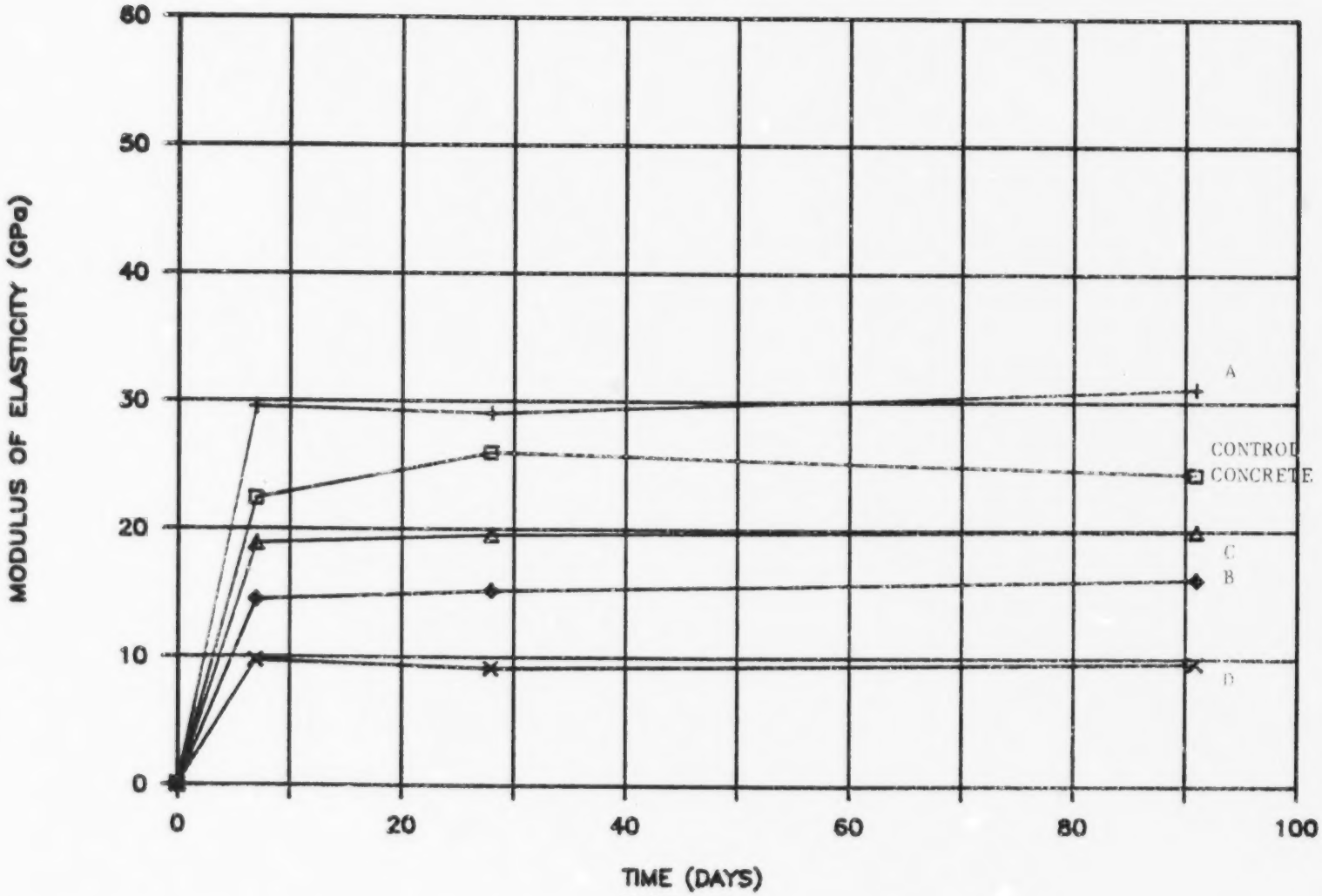


FIGURE E3
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 23°C DRY
PRODUCT: A,B,C,D

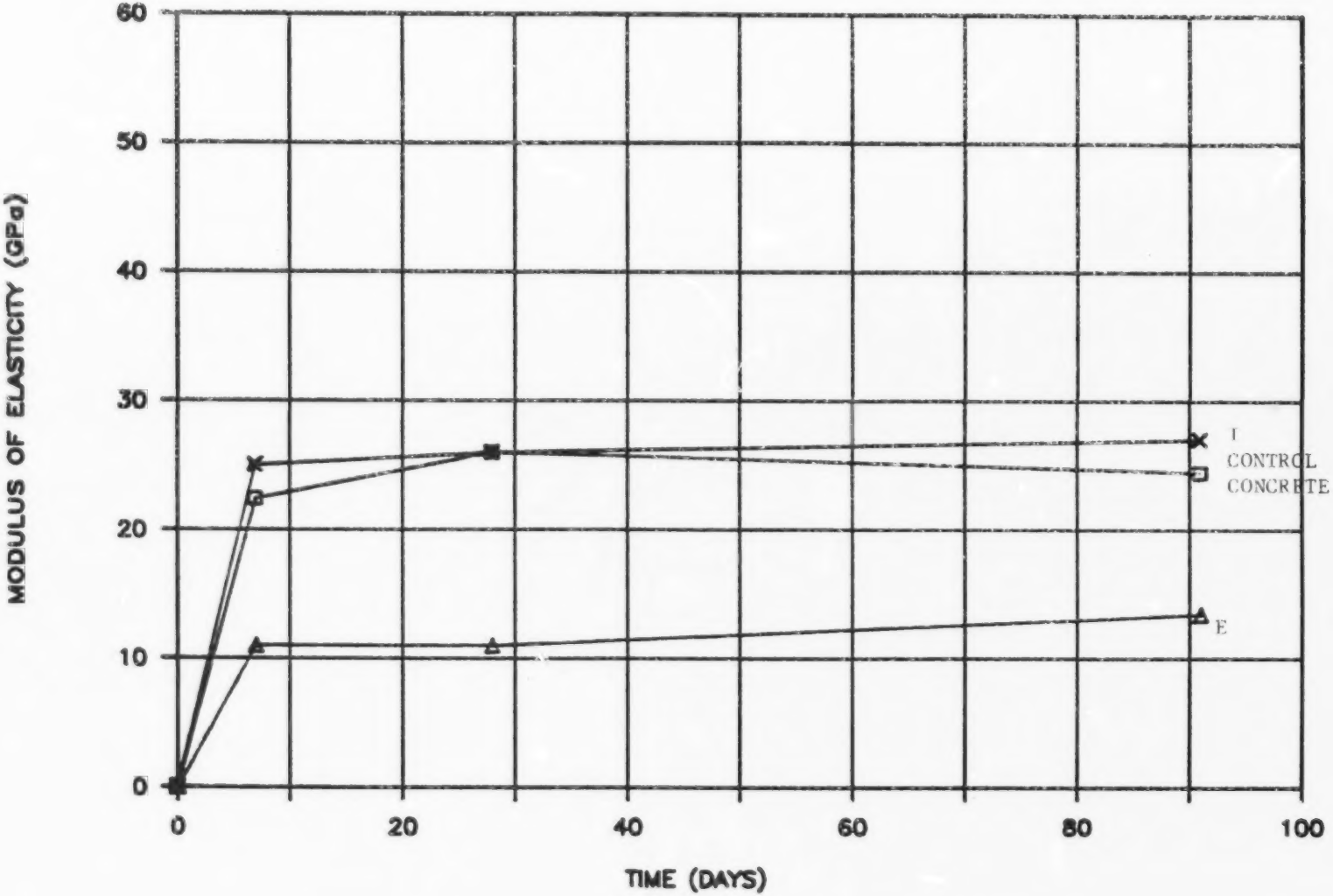


FIGURE E4
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 23°C DRY
PRODUCT: E,I

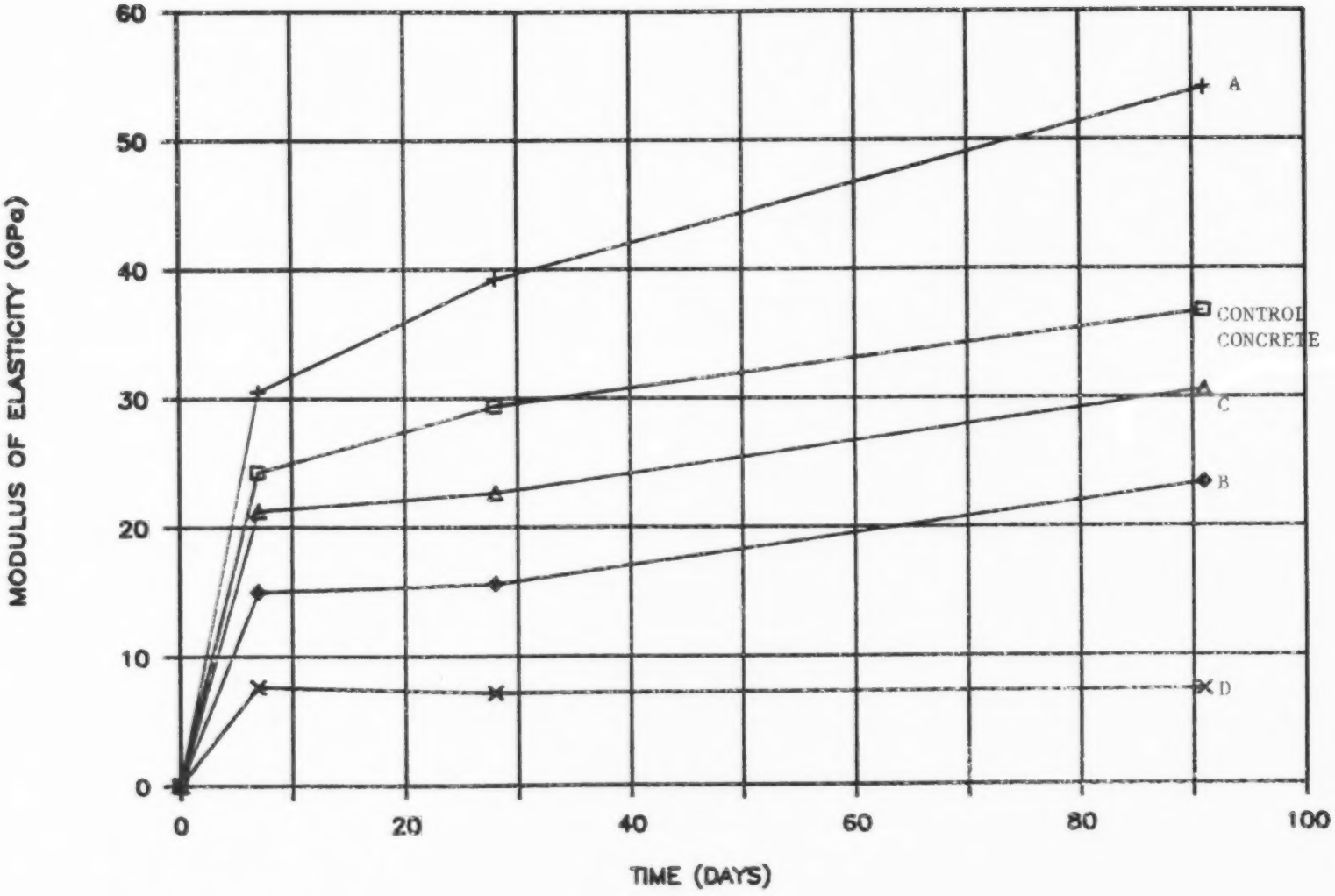


FIGURE E5
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 38°C/23°C WET
PRODUCT: A,B,C,D

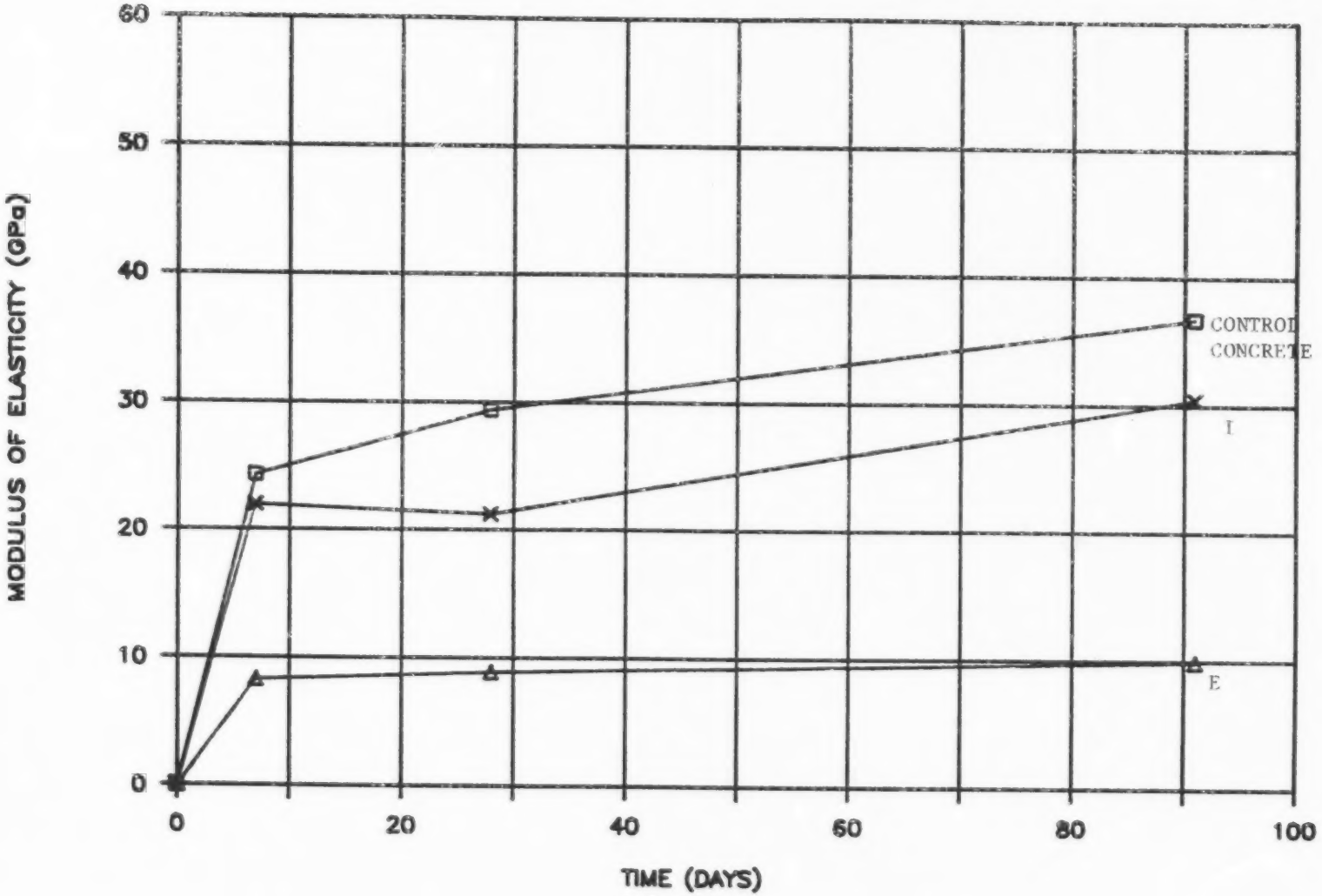


FIGURE E6
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: 38°C/23°C WET
PRODUCT: E,I

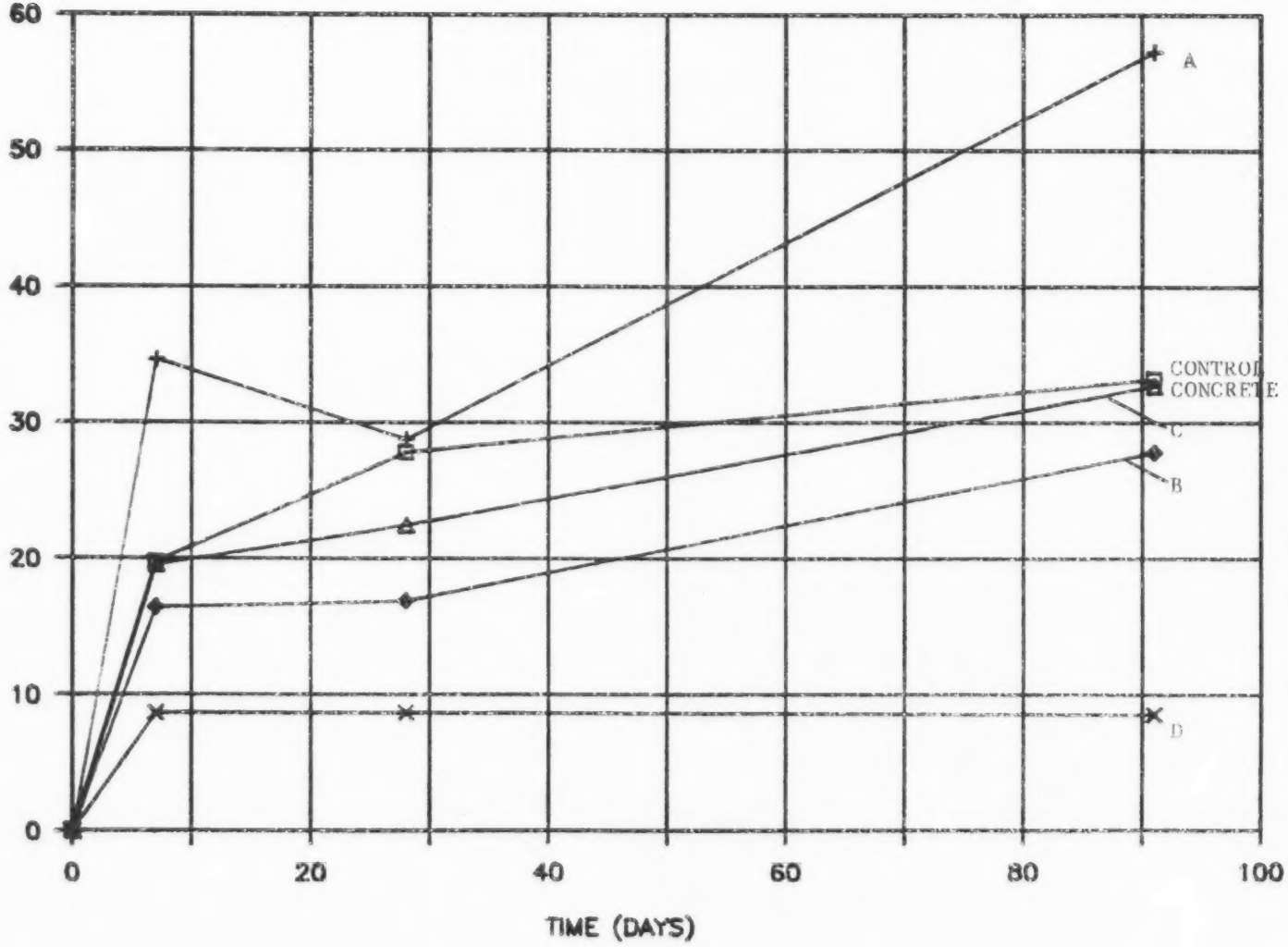


FIGURE E7

MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: -20°C/23°C WET

PRODUCT: A,B,C,D

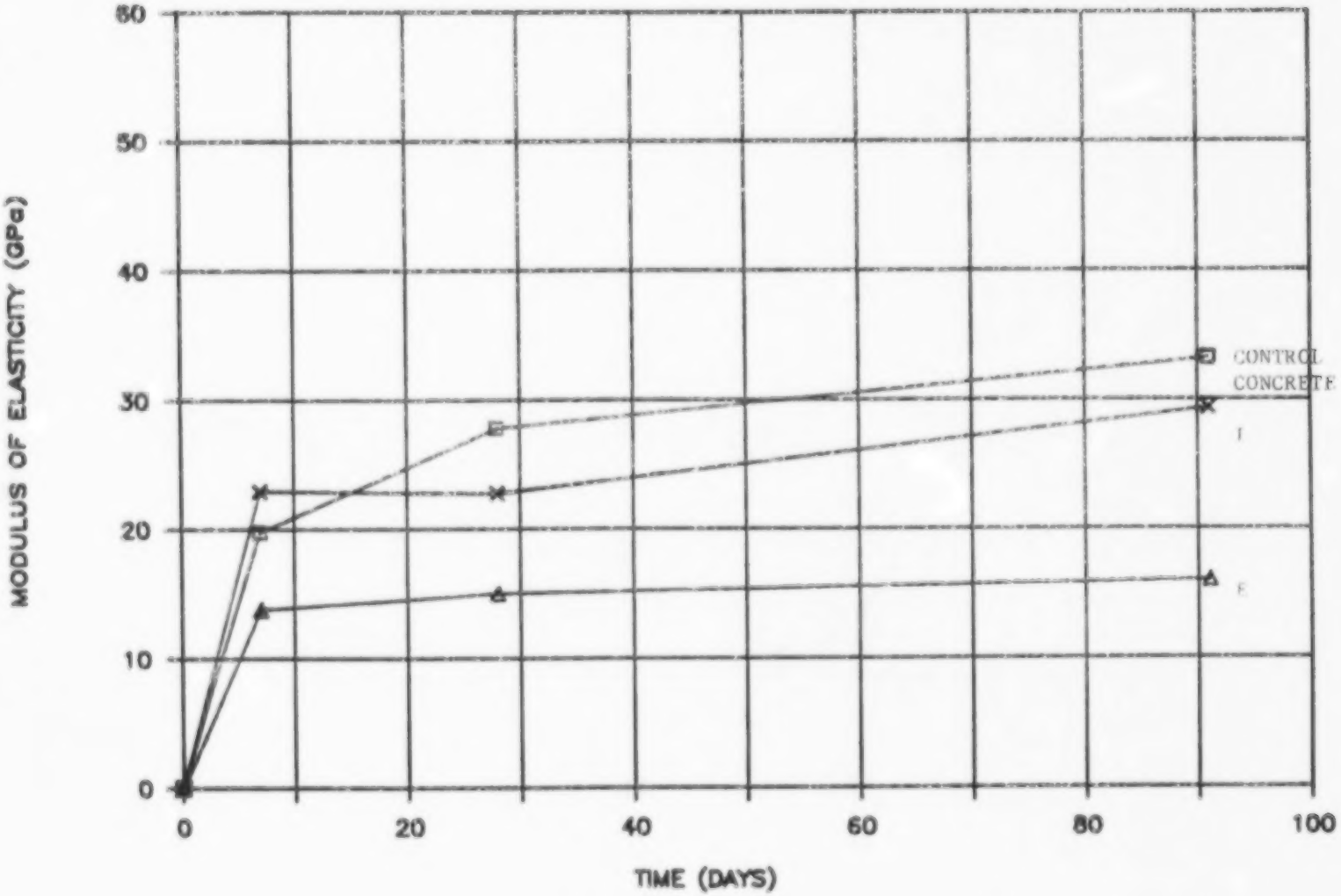


FIGURE E8
MODULUS OF ELASTICITY OF REPAIR MATERIAL SPECIMENS: -20°C/23°C WET
PRODUCT: E,I

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